DOCUMENT RESUME

ED 139 091 EA 009 504

TITLE	Population and School Enrolment: A Statistical Analysis. Current Studies and Research in Statistics.
INSTITUTION	United Nations Educational, Scientific, and Cultural Organization, Paris (France). Div. of Statistics on Education.
REPORT NO	CSR-E-9
PUB DATE	75
NOTE	116p.; Not available in hard copy due to marginal legibility of original document
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	Age Grade Placement; Developing Nations; Elementary Secondary Education; *Enrollment; Enrollment Projections; Mathematical Models; *Research Methodology; *School Demography; *School Statistics; *Statistical Analysis; *Tables (Data)

ABSTRACT

This publication consists of three papers that deal with the statistical evaluation of the inschool and out-of-school population of UNESCO member nations from a purely demographic viewpoint. Particular attention is devoted to the statistical aspects of measuring school retardation, the age structure of the enrolled and not-enrolled population, and the use of enrollment ratios and intake rates for measuring school participation for different age groups. The studies have the dual purpose of publishing raw data of the age distribution of inschool and out-of-school youth, as well as providing statistical analyses and projections based on these data. The individual papers include "A Statistical Analysis of Age Data and the Measurement of School Retardation," by P. Bernard; "School Enrolments and Demographic Structures," by D. Blot; and "Employing Enrolment Ratios and Intake Rates for Developing Countries: Problems and Shortcomings," by B. Fredriksen. (JG)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED139091

CSR-E-9

Enquêtes et recherches statistiques : travaux en cours
Current studies and research in statistics

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Population and School Enrolment: a Statistical Analysis

Division of Statistics on Education
Office of Statistics
1975

EA 009 504

2

Unesco

Titles already published in this series
by the Division of Statistics on Education

CSR-E-1 - *Costing Educational Wastage : a Pilot Simulation Study*, 1970 (english/french)

CSR-E-2 - *Las Estadísticas de la Educación en los Paises en Vias de Desarrollo*, 1972 (spanish only)
Also published in the series *Statistical Reports and Studies*, ST/S/13, 1968 (english/french)

CSR-E-3 - *Further Studies on the Evaluation of Internal Efficiency of Educational Systems : a Symposium*, 1972 (english/french)

CSR-E-4 - *A Survey of Statistics Teaching in Developing Countries*, 1974 (english/french/spanish)

CSR-E-5 - *Educational Growth and Educational Disparity*, 1973 (english/french)

CSR-E-6 - *The Statistical Dimension of Out-of-school Youth in Asia*, 1974 (english/french)

CSR-E-7 - *Foreign Students in Medical Schools*, 1974 (english/french)

CSR-E-8 - *Special Education Statistics*, 1974 (english/french)

§-§-§-§-§-§-§-§-§

These documents may be obtained from the Office of Statistics upon request.

PREFACE

During the last few years the Unesco Office of Statistics has collected through questionnaires, national publications and field missions a considerable amount of data on the age-distribution of school enrolment in its Member States. Generally such data are less frequently available than data on enrolment by level or grade of education. These data on enrolment by age have permitted, for the first time on a comparative international basis, to approach the statistical evaluation of the enrolled and out-of-school population from a purely demographic viewpoint. Such analyses are particularly relevant to developing countries where late entry and repetition lead to a wide age-range in each grade.

In addition to the purely pedagogical problems a wide age-span within a class may present to the teacher, this phenomenon also causes special analytical problems to the educational statisticians and planners. The Unesco Office of Statistics has launched therefore, within the framework of its Programme on Statistical Country Education Projections, a number of studies which have the dual purpose of publishing raw data on the age-distribution of school enrolment and out-of-school youth as well as providing statistical analyses and projections based on these data. Several such studies have already been completed*. The present document is a continuation of this effort. It is particularly concerned with the statistical aspects of measuring school retardation, the age-structure of the enrolled and not enrolled population and the use of enrolment ratios and intake rates for measuring school participation of different age-groups. Several other studies are currently being prepared for publication in the present series on *Current Surveys and Research in Statistics*. One of them will present several multivariate analyses attempting to identify factors explaining differences in enrolment ratios between countries. Other studies will provide analyses of past trends and projections of future enrolment and out-of-school youth, country-by-country, for all developing countries.

---

* See, for example :

- *Educational Development, World and Regional Trends and Projections until 1985*, Background paper prepared for the 1974 World Population Conference, Unesco Office of Statistics, Paris 1974 (english only).
- *Trends and Projections of Educational Enrolment in the 25 Least Developed Countries : A Statistical Analysis*, Paper prepared for the "Preparatory Expert Meeting for the Meeting of Senior Officials of the Ministry of Education of the 25 Least Developed Countries", Unesco Office of Statistics, Paris 1974 (english only).
- *The Statistical Dimension of Out-of-school Youth in Asia*, CSR-E-6, Unesco Office of Statistics, Paris 1975.
- *Educational Development in Africa : Trends and Projections until 1985*, Paper prepared for the African Ministers Conference on Education, Unesco Office of Statistics, Paris 1975.
- *La Croissance des Effectifs Scolaires des Pays du Sahel : Tendances et Projections jusqu'en 1985*, Paper prepared for the "Réunion d'Experts sur les Mouvements de Population et les Systèmes d'Education dans les Pays Soudano-sahéliens", Unesco Office of Statistics, Paris 1975 (french only).

TABLE OF CONTENTS

	Page
1. "A statistical analysis of age data and the measurement of school retardation", by P. Bernard, Unesco Expert in Statistics on Education, Gabon.	1
2. "School enrolments and demographic structures", by D. Blot, Central Analysis Division, OECD, Paris.	53
3. "Employing enrolment ratios and intake rates for developing countries : problems and shortcomings, by B. Fredriksen, Office of Statistics, Unesco.	64

§-§-§-§-§-§-§-§-§

A STATISTICAL ANALYSIS OF AGE DATA AND THE MEASUREMENT OF SCHOOL RETARDATION

P. Bernard

INTRODUCTION

In view of the need to measure and assess the considerable progress made in education over the last decade in the majority of countries, education planners, both at national and international level, have been obliged to devise statistical methods capable of providing sufficient relevant data on the output and efficiency of educational systems.

Hitherto, statistics on education were primarily used to provide a profile of the pupils enrolled, and this change in the manner in which such statistics are used represents a relatively recent development. It was not until J. Chipman published, in 1962, a report on his mission to Venezuela (1) and the studies carried out by D. Blot, published in 1965 (2), that the bases were defined for the so-called "reconstructed cohort" method, so widely used today.

The method is described very thoroughly in a recent publication in the new UNESCO series (3).

The study in question was carried out by the UNESCO Office of Statistics with the assistance of M.A. Brimer of Bristol University (U.K.). One of the appendices contains a selected list of studies and publications dealing with the problem of the analysis of statistics on education.

In broad terms, it will be called that this method consists in applying to an original cohort of 1,000 pupils rates of promotion and repetition occurring in successive grades and successive years, taken in paris, and in estimating maximum repetition or retardation for each grade.

---

(1) Unesco Educational Planning Mission - "Educación y economía en Venezuela : situación actual y proyectos de educación para impulsar el desarollo económico". Informe de la Misión de planeamiento de la Unesco, Julio-Agosto de 1962 - J. Chipman, jefe de la Misión, Paris 1963 - 264 p. (Unesco/VEN/PU1).

(2) Blot, D. - "Les déperditions d'effectifs scolaires : analyse théorique et applications", Tiers-Monde (Paris), tome VI, N°22, avril-juin 1965, p. 479-510.

(3) Unesco/IBE - A statistical study of wastage at school, Paris, Unesco 1972.

The method provides a great deal of valuable information concerning the efficiency of a national educational system, in particular such data as :

1° - the number of graduates produced by an original cohort of 1,000 pupils,

2° - the number of drop-outs by total and by grade,

3° - the number of pupil-years spent by the cohort as a whole,

4° - the investment per graduate in terms of pupil-years compared with the minimum investment required,

5° - the average number of years taken by graduates to complete their course,

6° - a table showing the process of school survival by grades.

The authors did not omit to stress the theoretical limitations of this method, the major one being that involved in applying probability factors for promotion and repetition to pupils in the various grades, irrespective of whether these were new enrolments or repeaters. However, as M.A. Brimer points out in his introduction to the study, "It is ..., in the last resort, the shortage of sufficient, relevant and reliable data which presents the most serious obstacle to any revolutionary breakthrough in the international study of educational wastage".

Moreover, as long as this situation remains unchanged, "the approach described ... must be regarded as the most effective that can be developed at the present time".

The definition of such a method obviously entailed defining the essential statistical data which it would require. This means in fact having available for every year figures for "enrolment per grade and by sex, together with the number of repeaters in each grade".

Such data are indispensable for analyzing the performance of an educational system, but are far from being available in all countries. For example, in January 1969, when the Office of Statistics sent a questionnaire to all Member States requesting them to supply information required for a quantitative analysis of school wastage in the 1st and general 2nd levels, only 58 countries supplied sufficiently detailed data for analysis purposes.

Thus, serious efforts are still needed to improve both the system for gathering such data and its reliability. With the same objective of gathering the maximum amount of data concerning the working of educational systems, research workers have been directing their attention to other forms of available statistical data - in this instance, data on the "age distribution of pupils within each grade". Such statistics were gathered to a lesser extent than the data referred to above and have been used mainly for calculating rates of enrolment by age and age group, as well as for making forecasts of school population. More recently, research has been directed to assessing the degree of school retardation on the basis of the pupil's age in a given grade.

An example of how age breakdowns can be used in this way is set out in the preparatory working document for the 32nd International Conference on Education in 1970, entitled "The Statistical Measurement of Educational Wastage" - UNESCO - ED/BIE/CONFINTED 32.

Although some work has been done in this area, it must nevertheless be admitted that no systematic research has been carried out and that age breakdowns available in the developing countries are only very rarely made use of by national planners. The usual reasons given to explain this lack of interest are of two types, i.e. :

1° - the unreliable nature of age statistics as a result of an inefficient Registrar-General's service,

2° - the difficulty of enforcing any regulation concerning a theoretical enrolment age in the 1st grade of the 1st level, with the result that there is often a large proportion of pupils who enrol at higher ages.

On the whole, such remarks are justified and obviously in the last analysis it is the reliability of such data which determines whether or not they can be used. Nevertheless, it should be pointed out that serious efforts are being made at the moment in several countries to improve the Registrar-General's service. Moreover, in many cases it is possible by means of a survey to estimate the degree of delayed enrolment, which makes a more accurate measurement of school retardation possible.

These considerations point to the need for clearly setting out all the relevant data which can be obtained from an age breakdown. Such is the object of the following study which is aimed at :

1° - describing the major difficulties involved in the gathering and utilization of age data and assessing the significance of the information obtained (cf. Chapter I) ;

2° - demonstrating in a systematic and comparative manner how such data can be analyzed :

. on the one hand, for the various grades concerned,

. on the other hand, for the various age groups (cf. Chapter II) ;

3° - showing how, on the basis of such a breakdown, it is possible to assess the efficiency of investment in terms of pupil-years in relation to the number of pupils concerned and how this indicator can be adjusted to take account of delayed enrolment (cf. Chapter III).

It should be added that the analysis of age data set out in this study was actually done during the course of the author's mission in Gabon (1972-1975). The first phase comprised a study of 1st level pupils in Libreville which was later extended to cover all 1st level pupils in Gabon. This approach, which was very concrete and easily carried out, convinced planners in Gabon of the need :

- to organize the gathering of such data on a regular basis,
- and above all to make systematic use of the statistical information so obtained.

One cannot overemphasize the need for planners in the various developing countries to use for their own ends such data as they have available. All too often such information is gathered in response to requests from foreign universities, organizations and research and documentation centres.

CHAPTER I - GENERAL OBSERVATIONS ON THE GATHERING OF AGE DATA AND THE VALUE OF THE VARIOUS INDICATORS

1.1 - Gathering the data

1.1.1. Reliability of age data

Since in theory the age recorded for a pupil is taken from a Registrar-General's document, the reliability of such data depends on the efficiency of the Registrar-General's service in the country concerned. It is well known that in most developing countries the efficiency of this service leaves much to be desired. Therefore the age recorded for a pupil is often either what he himself declares it to be or taken from a "certificate of apparent age" - neither of which guarantees the accuracy of the data.

Aside from this basic problem, which can only be solved by improving the services of the Registrar-General, there are other factors affecting age data. For example, an age qualification for entry into certain educational cycles encourages some pupils to adjust their age in consequence. Adjustments of this kind can however be prevented provided that the pupil's year of birth, even if incorrect, is recorded when he is initially enrolled in the 1st level and this accompanies him throughout his scholastic career in the form of an identification number.

1.1.2. Classification according to age*

One must define clearly what is meant by the "age" of a pupil both at the time of enrolment and when the data is submitted. The classifications used here show the pupil's age in terms of "full years".

A pupil shown as being x years old at the time of enrolment is defined as one who was born :

"x years plus less than 365 days prior to that date"

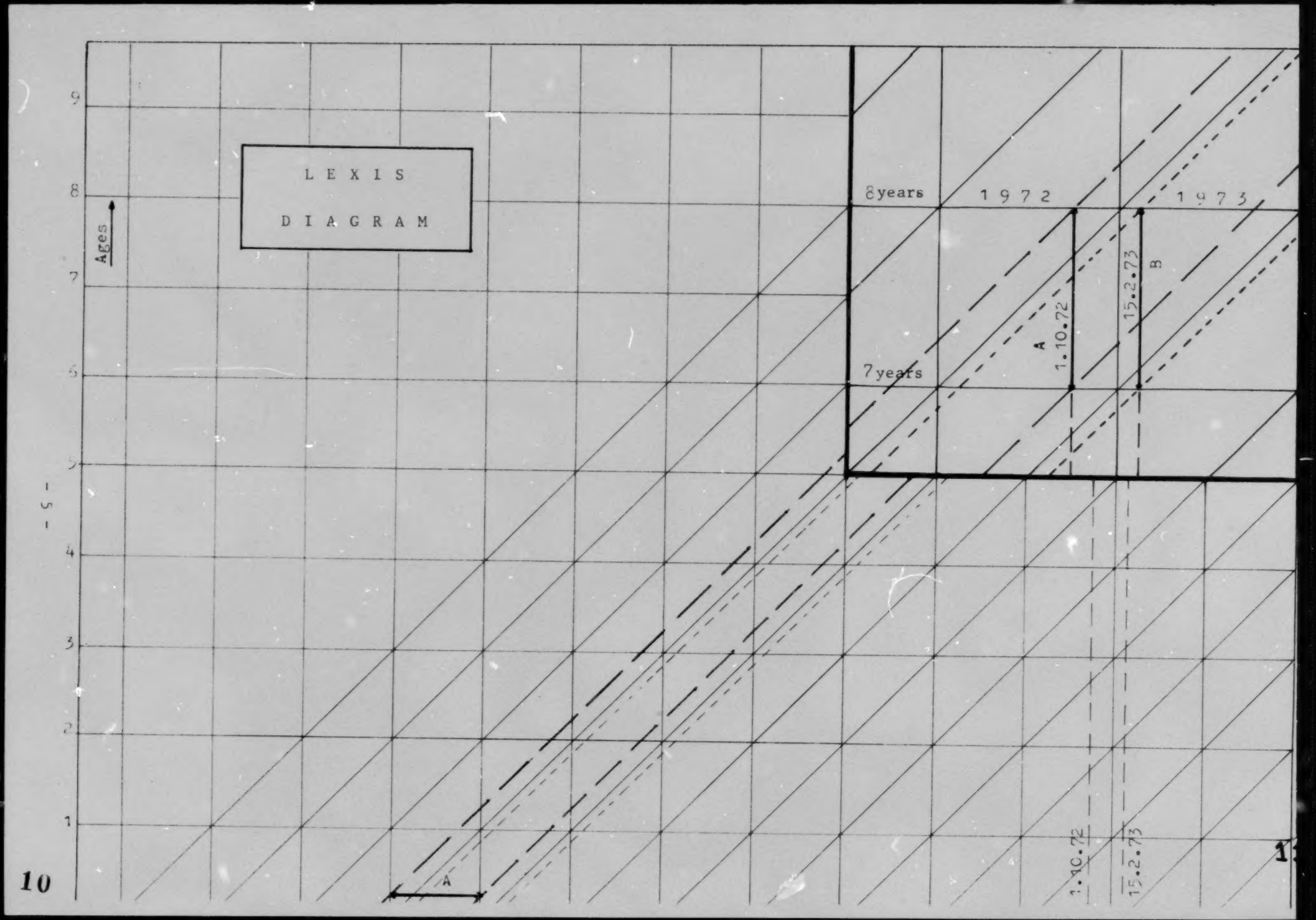
With this method for defining age, obviously the date of enrolment will considerably affect the breakdown. Although enrolment theoretically takes place at the same date i.e. at the beginning of the academic year, in all the schools of the country concerned, quite often it occurs at different dates, sometimes with a difference of as much as 3 to 4 months. The effect of this is to classify in the same age group pupils of different ages born at different periods of the year, as the following example shows. Pupils shown as 7 years old on 1st October 1972, for instance, were born between 1.10.64 and 30.9.65, whereas pupils shown as 7 years old on 15 February 1973 were born between 15.2.65 and 14.2.66, as can be seen from the following Lexis diagram.

---

* Note : The age classifications shown both in the text and in the accompanying diagrams and graphs are based on the following method : children having passed their 6th birthday for example :

- are included in the age 6 category in the tables and graphs,
- are treated as being 6 years old in the calculations.

The most common method is to use 6.5 in both cases. Any reader who wishes to have figures obtained using this other method need only apply the factor 0.5 to the calculations and the graph axes.


LEXIS
DIAGRAM
Ages
9
8
7
6
5
4
3
2
1
8years
1 9 7 2
1 9 7 3
7years
A
1.10.72
15.2.73
B
A
1.10.72
15.2.73

10

1.1.3. Classification by year of birth

In many countries the difficulty of enrolling pupils at the same date in all educational establishments makes enrolment by year of birth preferable. This enables an age breakdown to be made as of 1st January of the cu current school year, irrespective of the enrolment date. It has the added advantage of classifying pupils by generation, which makes it possible to study educational levels for each generation.

It should however be mentioned that an age breakdown as of 1st January has the effect of "ageing" pupils by the number of months or weeks which have elapsed since the beginning of the school year. This "ageing" factor needs to be taken into account when assessing the amount of school retardation in each grade. This will be seen in Chapter II, in the case of the Netherlands.

1.2 - Value and limitations of the indicators

1.2.1. Indicators of flow

The series of fndicators calculated on the basis of data by age and by grade constitute indicators of flow (or transversal indicators in demographic analysis), in contrast to the cohort indicators (or longitudinal indicators) calculated on the basis of the reconstructed cohort method. A flow indicator, calculated on the basis of a cross-section of the school life of different cohorts and generations, will be very sensitive to non-repetitive events which may occur during the school year. For example, any new administrative measure affecting intake, repetition, promotion, examination success, expulsion, etc., will have a marked effect on this type of indicator, whereas a similar measure, analyzed within the context of a cohort or generation, would have a far less marked effect.

1.2.2. The population involved

Indicators calculated on the basis of age breakdowns are concerned solely with the surviving members of the original cohorts and differ therefore from those indicators which can be calculated by the reconstructed cohort method and which reflect the number of pupil-years invested in terms of the total number of pupils, including those who dropped out before the end of the cycle. It should however be mentioned that, in addition to the global indicators mentioned above, longitudinal analysis will provide certain indicators which refer only to survivors from the cohort, e.g. "the average number of years taken by successful completers". A similar indicator, calculated on the basis of the age criteria, e.g. "the average number of school years for pupils enrolled in the last year of the cycle", will supply the same type of information for pupils from different cohorts who are all in the same grade.

The object of an age analysis during the course of the school year is thus not to replace studies based on cohorts, but rather to provide additional information on which to assess at a particular point in time situations which are constantly changing.

Such ad hoc surveys may in fact be a necessity, where there are no adequate arrangements for continuous data collection.

1.2.3. School retardation

The generally accepted definition of retardation is when a pupil in a grade is at least one year older than he should be according to the educational regulations. Assuming initial enrolment at the prescribed age and regular attendance, on the basis of pupils' actual ages in a given grade it is possible to calculate the number of years they have been attending school and hence the number of years taken in excess of the minimum required to attain that grade. School retardation as measured by this method is equivalent to the total number of repeated years, which is valid for countries where rules governing the age of compulsory enrolment are strictly applied.

The situation is much more complicated in developing countries, since there may be many different reasons for school retardation. These reasons can be classified as follows :

1° - Administrative reasons, that is to say outside the individual's control, e.g. a change in the age for enrolment in the first year of a cycle.

2° - Socio-economic reasons, e.g. :

- Insufficient intake facilities,
- The remoteness of schools and absence of boarding facilities,
- The use of children for work on the land,
- Health, etc.

3° - Scholastic reasons per se for repeating

The first two types of reason will in fact produce delayed enrolment, i.e. at an age greater than that prescribed in the regulations. Consequently, the school retardation recorded will be partly due to delayed enrolment and partly due to repeated grades. In order to assess this information correctly in the case of developing countires, it is thus necessary :

1° - to know all the administrative changes which have occurred in previous years ;

2° - to be able to estimate the extent of delayed enrolments.

In order to give a clear indication of how age data can be used, this chapter will be devoted to listing the major series characterizing the position in each grade. It will also include an analysis of the scholastic status for each age group, which provides very useful information and constitutes a natural extension of the analysis by grade.

2.1 - Distribution of pupils by grade

2.1.1. Method

In order to compare the age distribution within the various grades, this will be calculated on a percentage basis, as shown in the example below.

Table I - Pupils in the CP_2 (2nd year) - 1st level - Public schools
Libreville - GABON - 1972

Age.....	6	7	8	9	10	11	12	13	14	Total
Enrolment	45	362	481	426	228	100	25	8	2	1.677
%	2.7	21.6	28.7	25.4	13.6	6.0	1.3	0.5	0.2	100.0

The statistical distribution in this table can be described in terms of basic age distribution characteristics :

- The modal age is the age which occurs most frequently, i.e. in Table I this is age 8 with 481 pupils, or 28.7% of the total.
- The median age is the age above and below which 50% of the pupils' ages lie, i.e. in this example, this would be age :
  $\frac{N}{2} + \frac{1}{2}$ = the 839th pupil who would be 8-9 years old (N = Total number of pupils).
- The average age which is calculated from the following formula :

$$X = \frac{1}{N} \sum_{i=1}^{n} n_1 x_1$$

N = Total number of pupils

x = Age

n = Number of pupils in an age group

In the example of the CP_2 grade, the average age of the pupils enrolled works out at 8.52 years (cf. note page 4).

In addition to these descriptive characteristics, there is another characteristic pertaining to educational statistics, i.e.

"the normal age for the grade".

For the majority of countries, the educational regulations stipulate that enrolment in the 1st grade of the 1st level should be at a certain age. In so far as it is considered normal for a pupil to progress through the different stages of the cycle at an annual rate, _____, if his age on enrolment in the 1st grade was x, the normal age for the 2nd grade will be x + 1, for the 3rd grade x + 2, and so on.

2.1.1.1. School retardation

It thus follows from this definition that a pupil who has more than the "normal" age for his grade has not progressed at the expected rate and has fallen behind. If one continues to assume that all the pupils under study were enrolled in their 1st grade at the prescribed age, one is able to calculate the number of excess years spent in the educational system by deducting :

"the normal age for a grade from the actual age".

2.1.1.2. Initial results

Once the abovementioned calculations have been performed, the following information can be deduced :

1° - The relative degree of retardation in a given grade and, in some cases, the trend over several years :

2° - The difference between the normal and modal ages :

3° - The difference between the normal and average ages : the difference between these two ages represents the average cumulative retardation for pupils in a given grade.

Figure I shows these figures in the case of one grade.

2.1.1.3. The problem of delayed enrolment

As was mentioned above, the task is complicated by the fact that in the majority of developing countries not all pupils begin school at the prescribed age. Thus, in the statistical example quoted above (cf. Table I), an 8-year-old pupil in 2nd grade will have spent 4, 3 or 2 years in the school system depending on whether he was enrolled at age 5, 6 or 7. In the absence of any data on the age of initial enrolment, what significance has the figure showing the number of years' difference between the normal age and actual age in a given grade? The results of such a calculation will constitute :

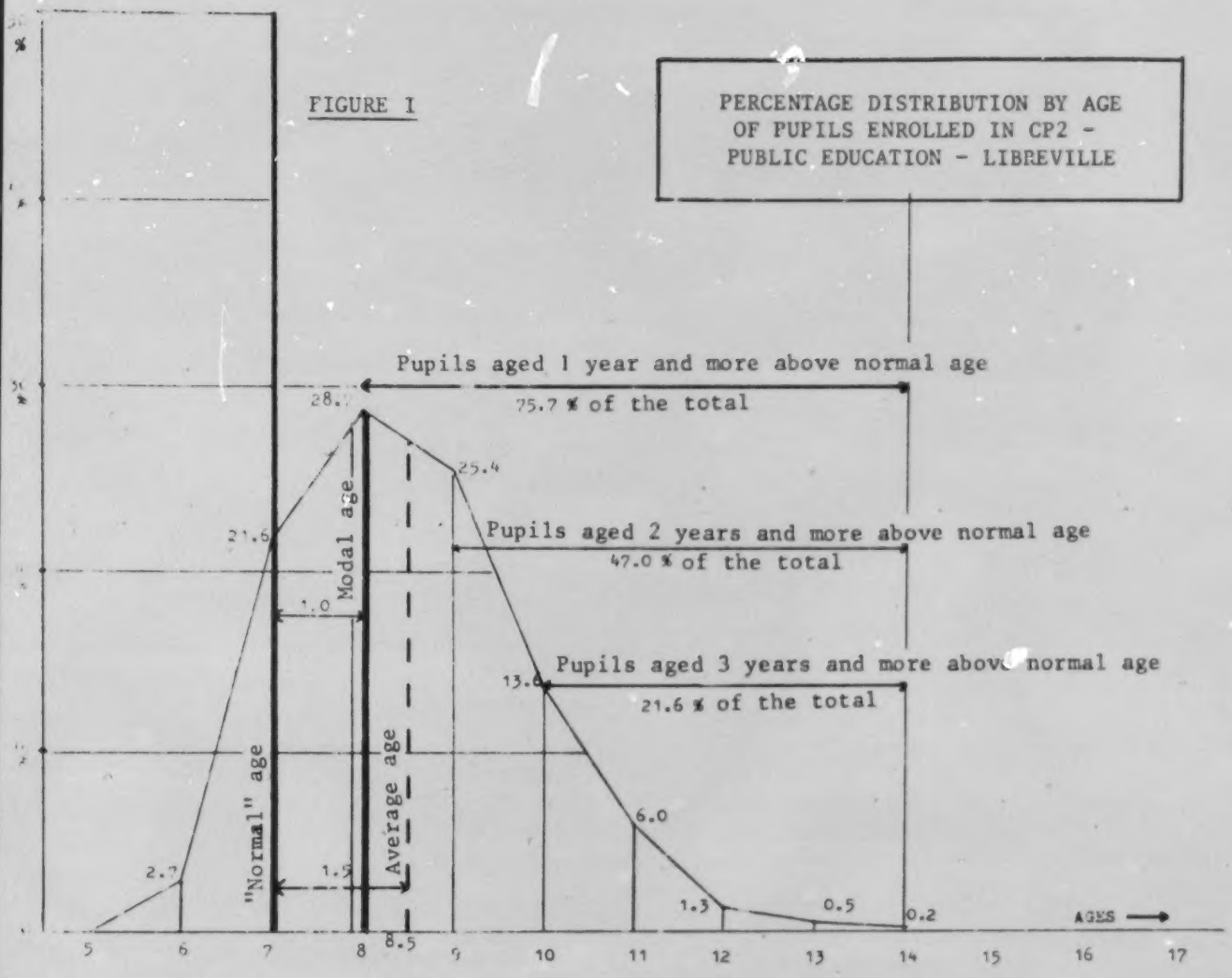
"a measure of the maximum possible retardation for a grade or age group".

Assuming that it were possible to estimate the degree of delayed enrolment, it is easy to understand how valuable it would be for educational planners to make regular use of breakdowns by age and grade in view of the importance of the data which these will be able to provide once school retardation has been assessed. Amongst other things, such data would include the following :

- the amount of cumulative repetition built up during a pupil's career;
- the speed of progress through a school system :
- the number of years required to get pupils up to a given grade :
- the cost of the education, since the number of years spent in school can be expressed in financial terms.

FIGURE I

PERCENTAGE DISTRIBUTION BY AGE OF PUPILS ENROLLED IN CP2 - PUBLIC EDUCATION - LIBREVILLE



These various indicators will be described in detail in the following paragraphs.

2.1.1.4. The distribution of pupils according to their scholastic achievement

When the normal age for a grade has been defined, pupils can be classified according to the number of years they are ahead of, or behind, the normal grade age. On the basis of resulting classification of pupils according to their scholastic achievement it will be possible :

- either to compare the different grades directly ;
- or to analyse the change in the pattern of scholastic achievement between the first and the last grades.

Example : The trend from grade to grade in the relative number of pupils with one year of retardation compared with the normal age.

These two types of comparison are shown in Figures III and IV (cf. Table V).

2.1.2. Statistical examples

In order to illustrate what has been said above, the method as described will be applied to age data from 4 countries with different educational situations. In order to simplify the analysis, data for each country will include :

- a first table showing differences existing between the normal, modal and average ages ;
- a second table showing the percentage breakdown of pupils in each grade according to their scholastic achievement. Basic data, including breakdowns by age and grade, are provided as an appendix. In order to highlight the differences which exist, Figure II shows the percentage breakdown by age for each grade and for each of the 4 countries.

The countries selected are :

1° - Sweden - 1960 and 1969

An industrialized country with a system of automatic promotion and where the statutory age for initial enrolment is 7.

2° - Gabon - 1972

A developing country allowing repetition of a grade and whose statutory age for initial enrolment is 6.

3° - Columbia - 1960 and 1968

A developing country allowing repetition of a grade and whose statutory age for initial enrolment is 7.

4° - Netherlands - 1961 and 1968

An industrialized country allowing repetition of a grade and whose statutory age for initial enrolment is 6.

2.1.2.1. Note

Two important comments need to be made before analysing these data :

FIGURE II : PERCENTAGE DISTRIBUTION BY AGE OF PUPILS ENROLLED IN EACH GRADE OF PRIMARY EDUCATION

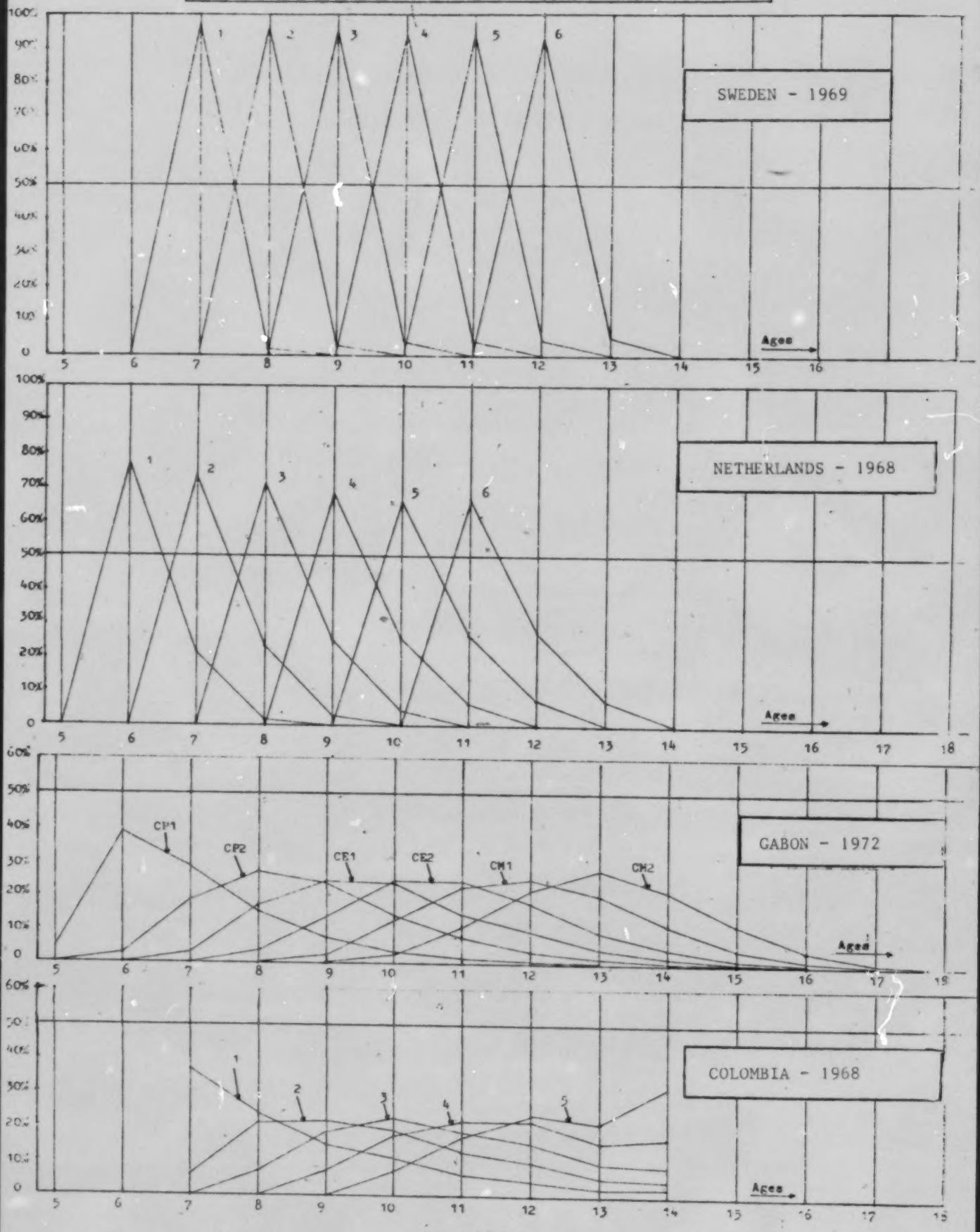


FIGURE III

PERCENTAGE DISTRIBUTION OF PUPILS FIRST LEVEL COMPARED WITH NORMAL AGE IN EACH GRADE - 1972/73

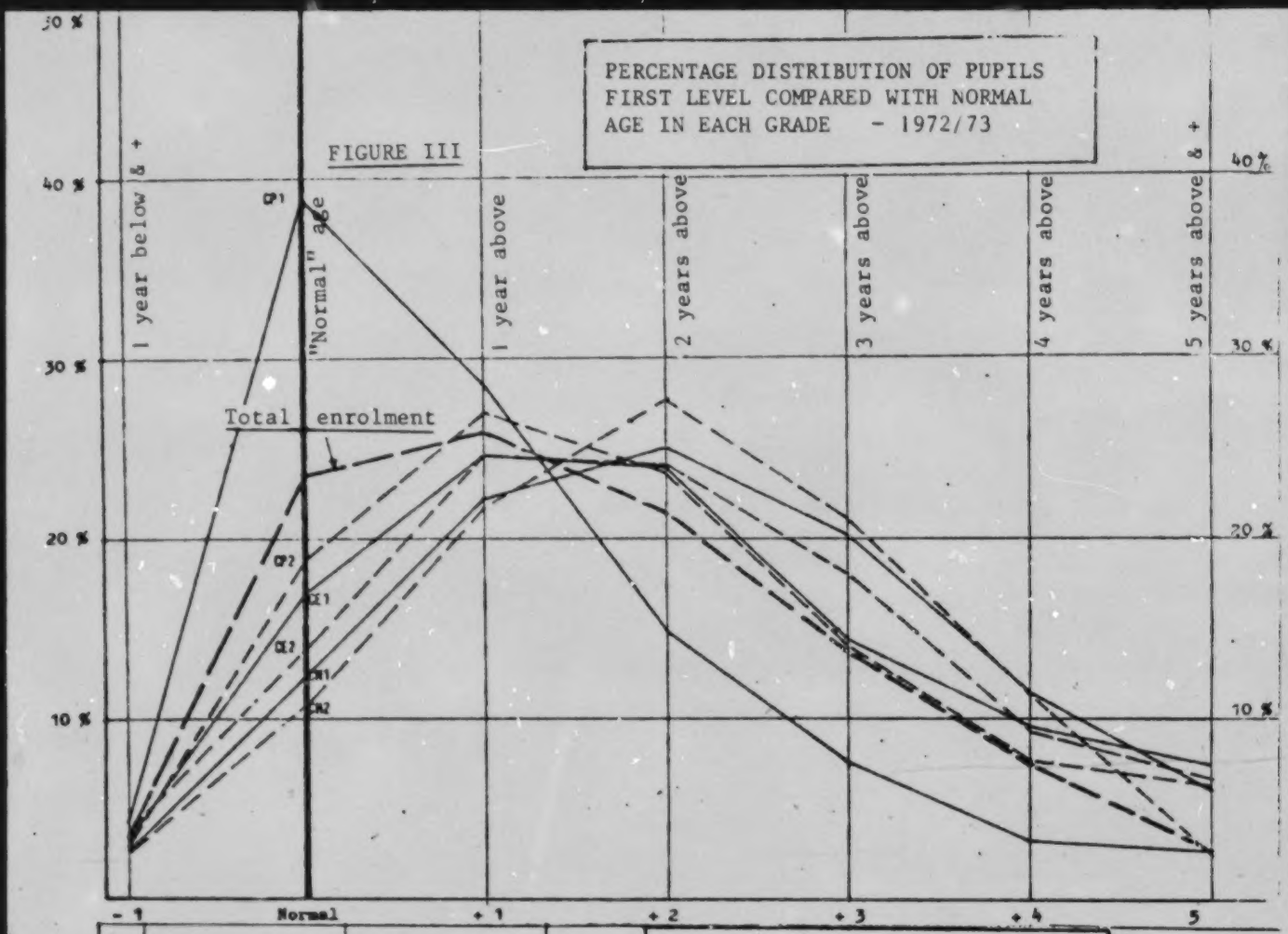
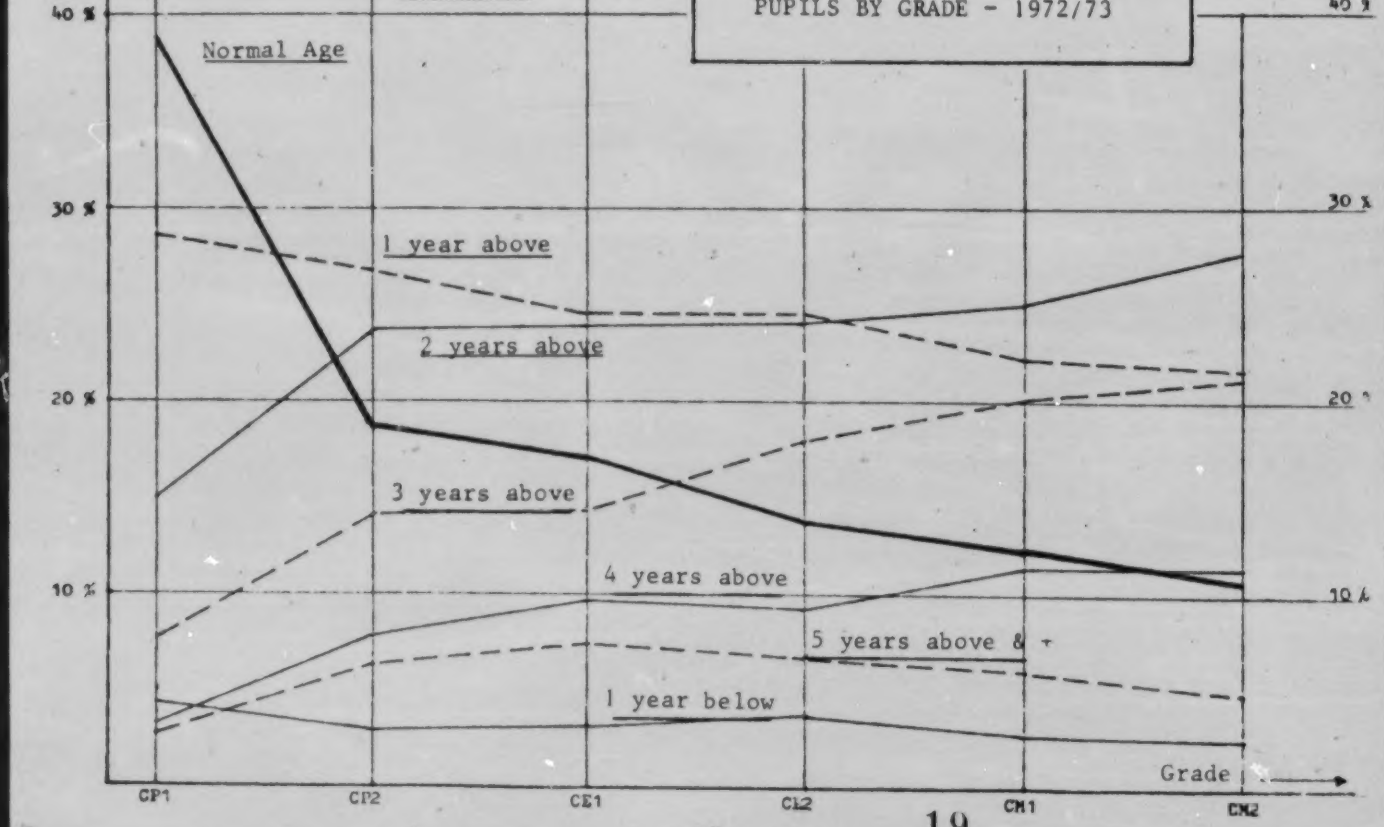


FIGURE IV

DISTRIBUTION OF OVERAGED PUPILS BY GRADE - 1972/73



1° - The comparison of age breakdowns for non-consecutive years

In the case of three out of the four countries, the available data enables the situation to be compared after a lapse of 7, 8 and 9 years respectively. One must however keep in mind the limitations of such a comparison, since temporary factors can be the cause of marked variations between the two age breakdowns. It is essential, therefore, to have a thorough knowledge of relevant demographic data, as well as of any modifications in educational regulations and intake capacity, in order to put any changes which may have occurred in their proper perspective.

2° - Age breakdowns as of 1st January of the current school year

The various indicators described above can only be of value in assessing school retardation if they are calculated on the basis of the pupil's age at the beginning of the school year*, in view of the fact that the normal age corresponds to the age required at the time of enrolment in a grade.

Age breakdowns based on a later date therefore have the effect of "ageing" all the pupils by the number of months and weeks which have elapsed since the beginning of the school year. As an example, in the case of the Netherlands, the school year starts at the beginning of September, whereas the age breakdown used relates to 16 January. In order to assess school retardation accurately, it is thus necessary to adjust the figures in such a way as to obtain the age breakdown for the pupils as of the beginning of September, which can be done in the following manner.

If the difference between the beginning of the school year and the date of enrolment is rounded off to 4 complete months, and assuming that the birthdays of the pupils aged x at the beginning of January can be divided equally amongst the 12 months of the year, one can estimate that at the beginning of September :

1/3 of the pupils were in the age group x - 1 and 2/3 in the age group x.

In order to reduce the risk of errors which could arise if this method were applied to numbers which were too small, pupils in each grade have been grouped in three broad categories :

1° - those having the normal age or less,

2° - those having one year's retardation compared with the normal age,

3° - those having two or more years' retardation compared with the normal age.

This correction has the effect of reducing significantly the proportion of pupils with one or more years' retardation, as is obvious from a comparison of Tables IX and IX b - (cf. paragraph 2.1.2.5.).

---

* This comment applies only to those countries where the regulations stipulate that pupils should, for example, have had their 6th birthday before the beginning of the school year. The comment does not therefore apply to countries where it is sufficient if the 6th birthday occurs during the (calendar) year in which the pupil begins school. Such an adjustment is therefore only necessary in the case of the Netherlands.

2.1.2.2. Table II - Sweden - 1st level - 1960 and 1969

Variations	Years	1	2	3	4	5	6
Modal age...	1960	-	-	-	-	-	-
Normal age...	1969	-	-	-	-	-	-
Average age..	1960	0.03	0.04	0.06	0.06	0.07	0.07
Normal age...	1969	-	0.01	0.03	0.03	0.03	0.04

2.1.2.6. Percentage distribution of all pupils in one level according to their scholastic achievement

The breakdowns shown for the 4 countries under study, although not directly comparable, nevertheless give some idea of the diversity which can exist. This diversity is well illustrated in Figure V based on data in Table X.

2.2 - Analysis of the breakdown by grade in each age group

The statistical data used to analyse the age distribution of pupils in each grade can also be used to analyse the position within each age group. In fact, since there is a normal age for each grade, there is obviously a normal grade for pupils in a given age group. It is thus possible to analyse an age group in the same way as one analysed a grade. The various useful indicators obtained in this way will be described in Chapter III. This present section will be restricted to a description of the basic calculations and their immediate application.

Statistical example

On the basis of the data in Table VI (1st level - Colombia - 1968/1969), pupils can be reclassified by age group according to their scholastic achievement, as is shown in Table XI. The percentage breakdowns for each age group will feature as shown in Table XII. The degree of school retardation by age group can be derived directly from the figures in Table XI, illustrated in Figures VI and VII. By showing the percentage distribution figures in this way, it is easier to observe the trend within an age group. An example of this is the variation in the pattern of scholastic achievement for 13-year-old pupils between 1960/1961 and 1968/1969 (Colombia - 1st level). The available data is shown in Table XIII.

Analysis of the trend in this pattern gives a clearer picture of the increase in the enrolment coefficient for 13-year-old children, which has produced a slight improvement in the distribution by grades.

In order to reach a better understanding of the current situation in schools, it would seem vital for educational planners to carry out an analysis of grades attained by pupils of varying age-groups. Moreover, forecasts of enrolment, if they are to avoid being too vague in character, must also take account of these patterns.

Thus, if one possesses for a given grade :

1° - valid demographic data (total population broken down by age group - those attending school and those not).

2° - the breakdown of school pupils by age for each grade. it is then possible to calculate enrolment coefficients by age and by grade. these basic data being essential for making more detailed forecasts. To illustrate this, these coefficients have been calculated for Colombia (Table XIV).

TABLE III - PERCENTAGE OF ENROLMENT IN EACH GRADE WHICH IS UNDER-, NORMAL AND OVERAGE - PRIMARY EDUCATION - SWEDEN (Cont.)

Age/Grade situation \ Grades	Total enrolment		1st year		2nd year		3rd year		4th year		5th year		6th year	
	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
1 year below	1,87	1,59	1,61	1,38	1,63	1,57	1,90	1,60	1,93	1,62	2,07	1,66	2,04	1,69
Normal age	91,20	94,36	94,12	96,74	92,63	95,34	90,92	94,22	90,61	93,83	89,67	93,43	89,61	92,55
1 year above	6,59	3,97	4,18	1,88	5,56	3,09	6,86	4,18	7,04	4,55	7,80	4,77	7,82	5,49
2 years above	0,31	0,07	0,09	-	0,16	-	0,29	-	0,40	-	0,42	0,14	0,50	0,25
3 years above	0,03	-	-	-	0,02	-	0,03	-	0,04	-	0,05	-	0,02	0,02
4 years above	-	-	-	-	-	-	0,01	-	0,01	-	-	-	-	-
1 year above & +	6,93	4,04	4,27	1,88	5,74	3,09	7,19	4,18	7,49	4,55	8,27	4,91	8,34	5,76

2.1.2.3. TABLE IV - GABON - PRIMARY EDUCATION - 1972

Variations	Years	1	2	3	4	5	6
Modal age Normal age	1972	-	+ 1	+ 1	+ 1	+ 2	+ 2
Average age Normal age	1972	+ 1,1	+ 1,8	+ 2,0	+ 2,0	+ 2,1	+ 2,1

2.1.2.4. TABLE VI - COLOMBIA - PRIMARY EDUCATION - 1960 & 1968

Variations	Years	1	2	3	4	5
Modal age	1960	-	1	1	2	1
Normal age	1968	-	1	1	2	1
Average age	1960	1,73	2,08	1,87	1,77	1,61
Normal age	1968	1,58	1,96	1,81	1,72	1,54

2.1.2.5. TABLE VIII - NETHERLANDS - 1961 & 1968 (after adjustment)

Variations	Years	1	2	3	4	5	6
Modal age	1961	-	-	-	-	-	-
Normal age	1968	-	-	-	-	-	-
Average age	1961	0,03	0,13	0,21	0,30	0,38	0,39
Normal age	1968	0,02	0,09	0,16	0,21	0,26	0,25

TABLE V - PERCENTAGE OF ENROLMENT IN EACH GRADE WHICH IS UNDER-, NORMAL AND OVERAGE - PRIMARY EDUCATION - GABON (Cont.)

Age/grade situation	Total enrolment	CP_1	CP_2	CE_1	CE_2	CM_1	CM_2
1 year below & +	3,42	4,23	2,84	3,18	3,73	2,73	2,53
Normal age	23,32	38,73	18,76	17,02	13,77	12,43	10,72
1 year above	25,77	28,62	26,79	24,50	24,50	22,21	21,69
2 years above	21,28	14,90	23,59	23,88	24,05	25,00	27,61
3 years above	13,72	7,56	14,04	14,31	17,99	20,17	21,16
4 years above	7,44	3,30	7,75	9,68	9,28	11,40	11,34
5 years above & +	5,07	2,66	6,23	7,43	6,68	6,07	4,95
1 year above & +	73,26	57,04	78,40	79,80	82,50	84,84	86,75

TABLE VII - PERCENTAGE OF ENROLMENT IN EACH GRADE WHICH IS UNDER-, NORMAL AND OVERAGE - PRIMARY EDUCATION - COLOMBIA (Cont.)

Grades / Age/ grade situation	Total enrolment		1st year		2nd year		3rd year		4th year		5th year	
	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968
1 year below	1,8	4,0	-	-	3,1	5,8	3,2	7,0	3,0	6,9	5,6	7,0
Normal age	23,6	25,7	30,5	36,5	17,1	20,9	18,9	18,3	18,7	17,3	16,5	16,7
1 year above	24,2	22,7	25,2	23,6	22,1	21,7	23,8	22,5	23,5	21,7	27,9	23,4
2 years above	19,2	17,8	16,4	14,7	20,8	18,9	20,5	18,5	25,5	21,8	22,3	21,0
3 years above	14,8	14,4	12,1	10,4	14,8	12,7	17,7	15,4	15,9	15,5	27,7	31,8
4 years above	8,7	8,3	6,7	6,1	12,4	9,9	9,3	9,6	13,3	16,8	-	-
5 years above	4,8	4,3	5,1	4,2	5,8	5,3	6,7	8,7	-	-	-	-
6 years above	2,0	2,0	2,2	2,1	3,9	4,7	-	-	-	-	-	-
7 years above	0,8	0,9	1,7	2,2	-	-	-	-	-	-	-	-
1 year above & +	74,6	70,3	69,5	63,5	79,8	73,3	77,9	74,7	78,3	75,8	77,9	76,3

TABLE IX - PERCENTAGE OF ENROLMENT IN EACH GRADE WHICH IS UNDER-, NORMAL AND OVERAGE (BEFORE ADJUSTMENT)

PRIMARY EDUCATION - NETHERLANDS (Cont.)*

Grades / Age/ grade situation	Total enrolment		1st year		2nd year		3rd year		4th year		5th year		6th year	
	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
1 year below	0,19	0,09	-	-	0,09	0,06	0,17	0,08	0,25	0,12	0,34	0,16	0,32	0,16
Normal age	55,58	58,89	66,70	67,05	60,60	62,80	56,47	58,83	53,12	56,22	48,98	53,59	46,47	53,22
1 year above	34,00	34,10	30,77	30,83	33,34	32,78	34,28	34,47	33,93	34,94	34,90	35,72	37,06	36,49
2 years above	8,18	5,98	2,33	2,01	5,26	3,95	7,44	5,79	9,62	7,38	11,78	8,75	13,22	8,82
3 years above	1,81	0,84	0,15	0,09	0,61	0,36	1,39	0,74	2,54	1,18	3,48	1,58	2,85	1,24
4 years above	0,22	0,08	0,02	0,01	0,07	0,03	0,20	0,07	0,48	0,14	0,51	0,19	0,08	0,06
5 years above	0,02	0,02	-	-	0,02	0,01	0,04	0,02	0,06	0,02	0,01	-	-	-
1 year above & +	44,23	41,02	33,27	32,94	39,30	37,13	43,35	41,09	46,63	43,66	50,68	46,24	53,21	46,61

* cf. note p.14

TABLE IX (Bis) - PERCENTAGE OF ENROLMENT IN EACH GRADE WHICH IS UNDER-, NORMAL AND OVERAGE (AFTER ADJUSTMENT)

PRIMARY EDUCATION - NETHERLANDS (Cont.)*

Grades / Age/Grade situation	Total enrolment		1st year		2nd year		3rd year		4th year		5th year		6th year	
	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Normal age and below	66,78	70,35	77,0	77,32	71,80	73,78	68,07	70,39	64,68	67,98	60,95	65,65	59,14	65,54
1 year above	25,27	24,73	21,29	21,22	23,98	23,16	25,33	24,90	25,82	25,75	27,19	26,73	29,11	27,26
2 years above and +	7,95	4,92	1,71	1,46	4,22	3,06	6,60	4,71	9,50	6,27	11,86	7,62	11,75	7,20
1 year above and +	33,22	29,65	23,0	22,68	28,20	26,22	31,93	29,61	35,32	32,02	39,05	34,35	40,86	34,46
Average ages (adjusted)	-	-	6,03	6,02	7,13	7,09	8,21	8,16	9,30	9,21	10,38	10,26	11,39	11,25

* cf. note p.14

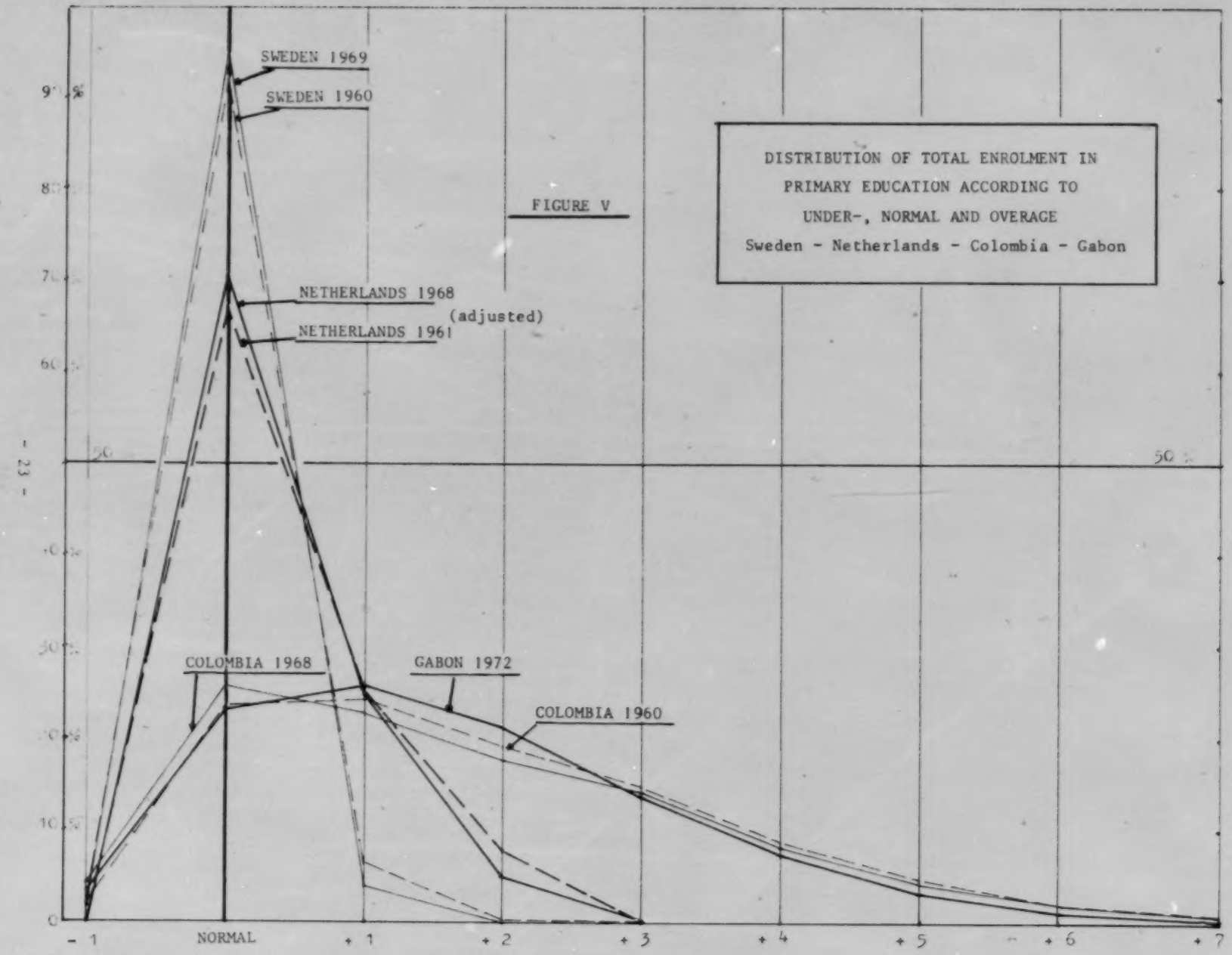


FIGURE V

DISTRIBUTION OF TOTAL ENROLMENT IN PRIMARY EDUCATION ACCORDING TO UNDER-, NORMAL AND OVERAGE

Sweden - Netherlands - Colombia - Gabon

FIGURE VI

COLOMBIA - PRIMARY EDUCATION - PERCENTAGE DISTRIBUTION OF PUPILS IN EACH AGE-GROUP WHICH IS UNDER-, NORMAL AND OVERAGE COMPARED WITH NORMAL AGE IN EACH GRADE.

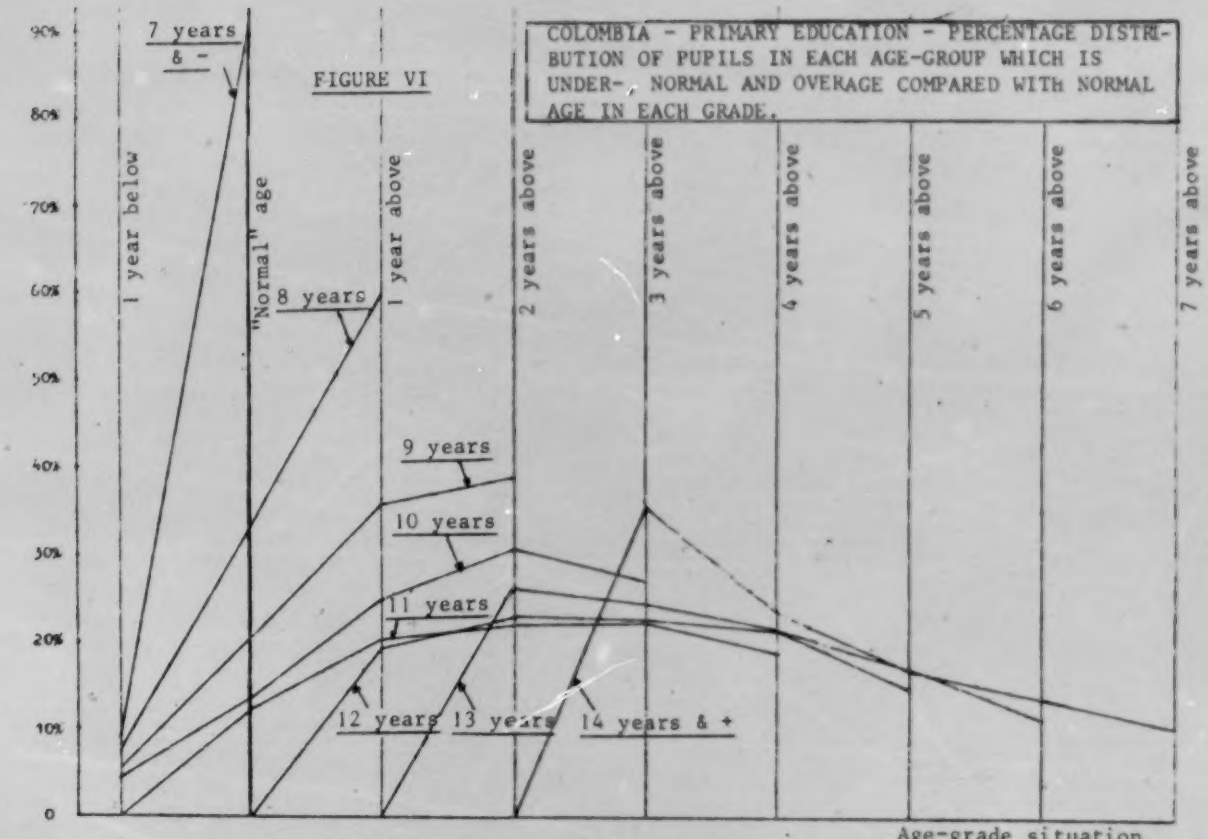


FIGURE VII

COLOMBIA - PRIMARY EDUCATION - PERCENTAGE OF ENROLMENT IN EACH AGE WHICH IS UNDER-, NORMAL AND OVERAGE

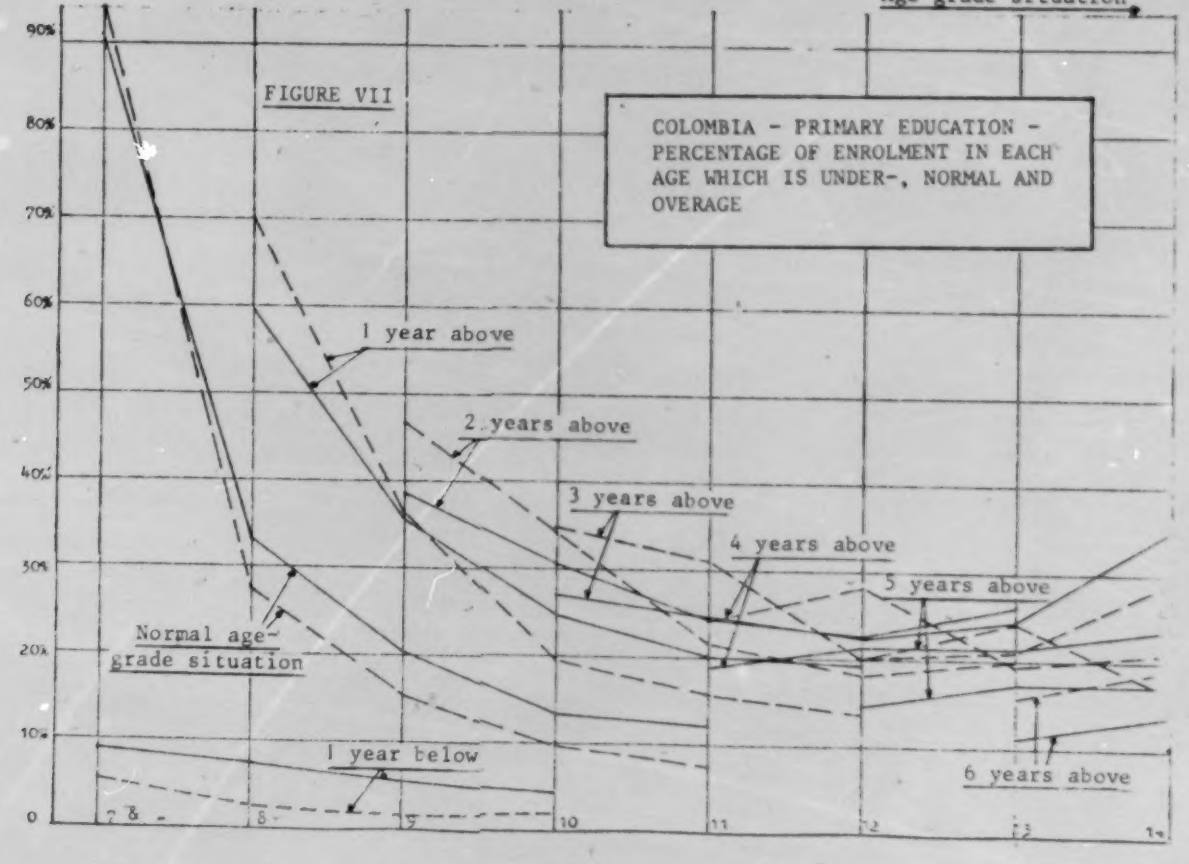


TABLE X - PERCENTAGE OF TOTAL ENROLMENT IN PRIMARY EDUCATION WHICH IS UNDER-, NORMAL AND OVERAGE

COUNTRY	Years	- 1	Normal	+ 1	+ 2	+ 3	+ 4	+ 5	+ 6	+ 7	1 year above and +
Sweden	1960	1,87	91,20	6,60	0,30	0,03	-	-	-	-	8,93
	1969	1,59	94,36	3,97	0,07	-	-	-	-	-	4,04
Netherlands	1961		66,78	25,27	7,95	-	-	-	-	-	33,22
	1968		70,35	24,73	4,92	-	-	-	-	-	29,65
Gabon	1972	3,42	23,32	25,77	21,28	13,72	7,44	5,07	-	-	73,26
Colombia	1960	1,80	23,60	24,20	19,20	14,80	8,70	4,80	2,00	0,80	74,60
	1968	4,00	25,70	22,70	17,80	14,40	8,30	4,30	2,00	0,90	70,30

TABLE XI - DISTRIBUTION OF PUPILS IN EACH AGE-GROUP ACCORDING TO UNDER-, NORMAL AND OVERAGE

COLOMBIA - PRIMARY EDUCATION - 1968

Age/Grade situation / Ages	Total enrolment	1 year below	Normal Age	1 year above	2 years above	3 years above	4 years above	5 years above	6 years above	7 years above
7 years & -	423.566	38.313	385.253	-	-	-	-	-	-	-
8 years	418.801	31.265	137.897	249.639	-	-	-	-	-	-
9 years	4e2.947	21.924	82.151	143.238	155.634	-	-	-	-	-
10 years	408.573	17.594	55.133	100.945	124.619	110.282	-	-	-	-
11 years	342.299	-	41.892	68.842	83.273	84.117	64.175	-	-	-
12 years	307.632	-	-	58.843	69.343	69.092	65.429	44.925	-	-
13 years	202.519	-	-	-	52.750	49.268	43.192	34.673	22.636	-
14 years & +	227.095	-	-	-	-	79.795	53.352	39.236	31.190	23.522
All Ages	2.733.432	109.096	702.326	621.507	485.619	392.554	226.148	118.834	53.826	23.522

TABLE XII - PERCENTAGE DISTRIBUTION OF PUPILS IN EACH AGE-GROUP ACCORDING TO UNDER-, NORMAL AND OVERAGE

COLOMBIA - PRIMARY EDUCATION

Age/Grade situation / Ages	% Total enrolment	1 year below	Normal Age	1 year above	2 years above	3 years above	4 years above	5 years above	6 years above	7 years above	1 year above & +
7 years & -	100,0	9,05	90,95	-	-	-	-	-	-	-	-
8 years	100,0	7,47	32,93	59,60	-	-	-	-	-	-	59,60
9 years	100,0	5,44	20,39	35,55	38,62	-	-	-	-	-	74,17
10 years	100,0	4,31	13,49	24,71	30,50	26,99	-	-	-	-	82,20
11 years	100,0	-	12,24	20,11	24,33	24,57	18,75	-	-	-	87,76
12 years	100,0	-	-	19,13	22,54	22,46	21,27	14,60	-	-	100,00
13 years	100,0	-	-	-	26,07	24,32	21,32	17,12	11,17	-	100,00
14 years & +	100,0	-	-	-	-	35,14	23,49	17,28	13,73	10,36	100,00
All Ages	100,0	3,99	25,69	22,73	17,76	14,36	8,27	4,34	1,96	0,86	70,32

TABLE XIII - PERCENTAGE DISTRIBUTION OF 13-YEAR-OLDS ACCORDING TO UNDER-, NORMAL AND OVERAGE

COLOMBIA - PRIMARY EDUCATION

School-years	4 Total enrolment	1 year above	2 years above	3 years above	4 years above	5 years above	6 years above	4 years above & +	Enrolment ratio of 13-year-olds (4)
1960/1961.....	100,0	-	19,88	26,71	19,31	24,14	15,13	59,18	29,2
1966/1967.....	100,0	-	26,71	26,94	19,50	16,71	10,15	46,36	38,3
1967/1968.....	100,0	-	27,58	25,67	19,91	16,72	10,12	46,75	39,2
1968/1969.....	100,0	-	26,07	24,32	21,32	17,12	11,17	49,60	-

TABLE XIV - AGE/GRADE ENROLMENT RATIOS - COLOMBIA - PRIMARY EDUCATION - 1967/1968

	Total Population (%)	Not enrolled (%)	Primary education						Primary & Secondary Education
			Total	1st year	2nd year	3rd year	4th year	5th year	
7 years	100,0	34,9	65,1	60,5	4,6	-	-	-	65,1
8 years	100,0	27,9	72,1	45,6	22,7	3,8	-	-	72,1
9 years	100,0	27,3	72,7	28,2	27,2	14,0	3,2	-	72,7
10 years	100,0	25,6	74,4	20,1	22,9	18,4	10,2	2,7	74,4
11 years	100,0	32,1	65,1	11,5	16,2	16,2	13,5	7,7	67,9
12 years	100,0	32,6	58,8	8,2	12,5	13,0	13,6	11,6	67,4
13 years	100,0	46,7	39,2	4,0	6,5	7,8	10,1	10,8	53,3
14 years	100,0	57,4	24,5	2,1	3,3	4,1	6,2	8,8	42,6
15 years	100,0	64,9	15,5	1,4	1,6	2,1	3,5	6,8	35,1
7 - 15 years	100,0	37,7	56,1	22,1	13,6	8,8	6,5	5,0	62,3

- 29 -

CHAPTER III - THE USE OF AGE DATA TO ASSESS EFFICIENCY OR INVESTMENT IN TERMS OF PUPIL-YEARS BY GRADE AND BY AGE GROUP

3.1 - Reminder

In an education system where all pupils start the first year of the cycle at the same age, it would be possible, knowing their ages at the beginning of each year, to calculate the period of time spent in the system; by comparing this with the minimum time required to reach the various grades, not only can the apparent retardation be calculated, but also the efficiency in terms of pupil-years invested.

In the case of countries with a high level of delayed enrolment, efficiency indicators calculated in this way represent what amounts to the minimum efficiency because delayed enrolment has the effect of reducing the actual number of years spent in the system. Where the proportion of delayed enrolments is known, the efficiency in terms of pupil-years invested can be assessed more accurately, as will be shown in paragraph 3.2.3.

3.2 - Basic calculations

To illustrate this, let us take the case of the distribution by age and grade for 1st level pupils in Libreville - Gabon - 1972.

The statutory age for enrolment in the first year is 6. On the basis that enrolment in a grade counts for one complete year, it is apparent that pupils aged 5 or 6 have accomplished one year, 7-year-old pupils two years, and so on. In the case of pupils in advance, the computation is based on their actual grade, e.g. the 75 pupils aged 7 and enrolled in the 3rd grade (CE_1) will have each spent three years in the system, i.e. 75 x 3 = 225 pupil-years in all. These computations are given in Table XV, where the number of completed school years, estimated on the basis of age, is given for all pupils. The last line but one of the table shows the minimum number of pupil-years required to attain that grade. For example, the 2,675 pupils enrolled in the 2nd grade (CP_2) have each spent a minimum of two years in the first cycle, i.e. 2,675 x 2 = 5,350 pupil-years in all. The last line of the table shows the sum of all the estimated pupil-years. For the second year, this amounts to 9,110 pupil-years.

In addition to the vertical totals for each grade, the same calculations are shown for each age group, i.e. the last two columns in the table give figures for:

a) the minimum pupil-years required for enrolment in the different grades. Thus, for pupils aged 7, the figure is :

$$1,584 \times 1 + 655 \times 2 + 75 \times 3 = 3,119 \text{ pupil-years} :$$

b) the number of pupil-years spent in the system, computed by the method described above, i.e. for pupils aged 7 :

$$1,584 \times 2 + 655 \times 2 + 75 \times 3 = 4,703 \text{ pupil-years.}$$

3.3 - Indicators

Once the basic figures have been computed, it is possible to work out several indicators characterizing the pupils' status.

3.3.1. For each grade

3.3.1.1. Average duration of schooling

This indicator is obtained by relating the investment in terms of pupil-years to the enrolment in that particular grade. For example, in the CP_2 grade, the 2,675 pupils will, on average, have spent the following amount of time in the system :

$$\frac{9,110 \text{ pupil-years}}{2,675 \text{ pupils}} = 3.41 \text{ pupil-years}$$

This figure should be compared with the minimum number of years required to attain the CP_2 grade, which is : 2 pupil-years. The average excess time is thus : 3.41 - 2.00 = 1.41 pupil-years in order to attain the CP_2 grade.

This excess thus represents the

"average retardation accumulated by pupils in the CP_2 grade".

It should be noted that because of the method adopted above this figure is equal to the difference between the actual average age and the normal age for the CP_2 grade (cf. paragraph 2.1.1.).

3.3.1.2. Ratio of pupil-years invested to pupil-years required (Cf. last two lines of Table XV)

For the CP_2 grade this ratio is as follows :

$$\frac{9,110 \text{ pupil-years}}{5,350 \text{ pupil-years}} = 1.7$$

which means that the real "cost" for enrolment in the CP_2 grade is 1.7 times as high as the minimum "cost" required.

3.3.1.3. Indicator of efficiency for the number of years invested

This is the reciprocal of the previous ratio :

$$\frac{5,350 \text{ pupil-years}}{9,110 \text{ pupil-years}} = 0.59$$

What this ratio indicates is that, in order to attain the CP_2 grade, where 100 pupil-years were invested, 59 pupil-years should have been sufficient - which amounts to saying that the efficiency of investment in terms of pupil-years was only : 59%.

These various indicators, based on the data in Table XV, are listed together in Table XVI. It will be noted that average cumulative retardation per pupil in each grade (6th line) increases progressively with each grade, rising from 0.79 pupil-years in the CP_1 grade to 2.16 pupil-years in the CM_2 grade, whereas the ratio pupil-years invested/pupil-years required drops progressively (1.79 for the CP_1 grade, as against 1.36 for the CM_2 grade), and the efficiency in terms of pupil-years invested increases progressively between the CP_1 grade (56%) and the CM_2 grade (73.5%).

This improvement in efficiency in terms of pupils years invested is largely the result of pupils with the most retardation dropping out from the system before reaching the CM_2 grade. Studies on a reconstructed cohort basis, covering 1,000 pupils from the 1st level, estimated the proportion of drop-outs occurring before the CM_2 grade at 60%.

3.3.2. For each age group

3.3.2.1. Average attainment

This indicator is obtained by dividing the number of pupil-years required (last column but one of Table XV) by the number of pupils in that age group.

Thus, for 7-year-old pupils this figure is :

$$\frac{3,119 \text{ pupil-years}}{2,314 \text{ pupils}} = \underline{1.35}$$

This figure is then compared with the average grade that 7-year-old pupils would have attained had their 4,703 pupil-years invested been 100% efficient, i.e.:

$$\frac{4,703}{2,314} = \underline{2.03}^*$$

3.3.2.2. Ratio of pupil-years invested to pupil-years required

This indicator is the ratio between pupil-years invested per age group (last column of Table XV) and the number of pupil-years required (last column but one of Table XV).

For 7-year-old pupils, for instance, this ratio works out as follows :

$$\frac{(1,584 \times 2) + (655 \times 2) + (75 \times 3)}{(1,584 \times 1) + (655 \times 2) + (75 \times 3)} = \frac{4,703 \text{ pupil-years}}{3,119 \text{ pupil-years}} = \underline{1.51}$$

This means that 7-year-old pupils have spent 1.51 times as many years in the system as was necessary to attain their present grades.

3.3.2.3. Indicator of efficiency for the pupil-years invested

This indicator is the reciprocal of the previous ratio :

$$\frac{3,119 \text{ pupil-years}}{4,703 \text{ pupil-years}} = 66\%$$

This means that, for 7-year-old pupils, for every 100 pupil-years invested, 66 should have been sufficient. These various indicators, which are derived from the data in Table XV, are listed together in Table XVII. One of the main things to notice is that the difference between the theoretical grade and the actual grade increases progressively with age, to attain a retardation of 6.5 years at age 17 (remembering that the normal age for the 6th grade - CM_2 - is 11 years).

Note: * Although 7-year-old pupils would normally be in the 2nd grade, 75 of them are in the 3rd year, which explains why this figure is 2.03 rather than 2.0.

In addition, it is apparent that the efficiency in terms of the number of years invested fluctuates around 66% between 7 and 12 years of age, and begins to decrease thereafter, dropping as low as 45.6% for 17-year-old pupils.

3.4 - Adjusting the coefficient of efficiency for pupil-years invested in respect of delayed enrolment

In countries where the regulations concerning the compulsory age for initial enrolment are not enforced, two trends are observable but with opposite effects, i.e. :

1° - delayed enrolment ;

2° - understatement of their age by certain pupils.

It is very likely, however, that the effect of delayed enrolment outweighs the effect of age understatement, since such understatement tends to occur during the latter years of the cycle, with the object of avoiding promotion to the senior cycle on an age basis. Assuming this to be the case, the figures in Tables XVI and XVII will denote the maximum school retardation, and thus the minimum efficiency coefficients for these groups.

It is however possible to improve the quality of these figures by attempting to assess the extent of delayed enrolment. Insufficient data are available to allow this adjustment to be made for each grade, and it would seem safer to apply such correction only to global figures for the group as a whole.

An estimate of the extent of delayed enrolment could only be obtained by means of a survey showing a breakdown in terms of the number of years involved, e.g. 1, 2 or 3 years, etc. The total number of years involved in this delayed enrolment, expressed in terms of pupil-years, should then be deducted from the total number of pupil-years invested, calculated on the basis of the compulsory age of enrolment. To simplify the presentation of the figures, the different delays recorded are expressed on the basis of a single year, e.g. a pupil with 2 years' delayed enrolment = 2 pupils with 1 year's delayed enrolment, and these figures can then be related to the group as a whole. For example, assuming that 100 pupils enrolled 1 year late, 100 pupil-years would have to be deducted from the total number of years invested, i.e. 62.468 - 100 = 62.368 pupil-years (cf. Table XV).

Table XVIII shows how the efficiency coefficient is affected as a result of varying degrees of delayed enrolment. It will be noted that delayed enrolment, by reducing the estimated time spent in the system, has the effect of increasing efficiency in terms of the years invested.

3.5 - Examples

To illustrate what has been described above, the following pages contain tables showing the indicators which have been worked out for Sweden (1960), Gabon (1972) and Colombia (1960 and 1968), by grade and by age.

The most important of these indicators are also depicted, by grade and by age, in Figures VIII-XI.

- Comments on these tables of indicators - 1st level

3.5.1. Sweden - 1960

The indicators by grade clearly illustrate the low degree of retardation in relation to the optimal pattern of scholastic progress in the 1st level. This is primarily due to a system of automatic promotion. On an age basis, accumulated

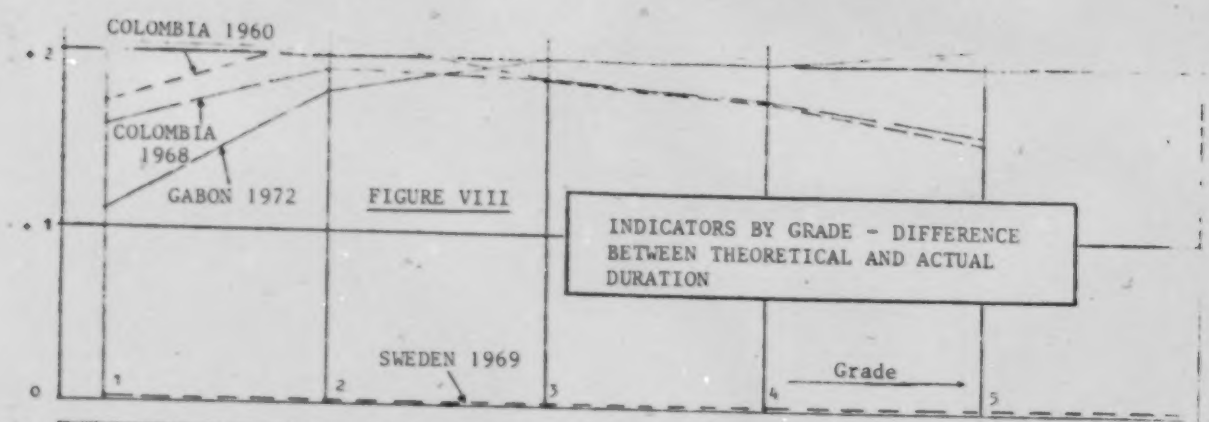


FIGURE VIII

INDICATORS BY GRADE - DIFFERENCE BETWEEN THEORETICAL AND ACTUAL DURATION

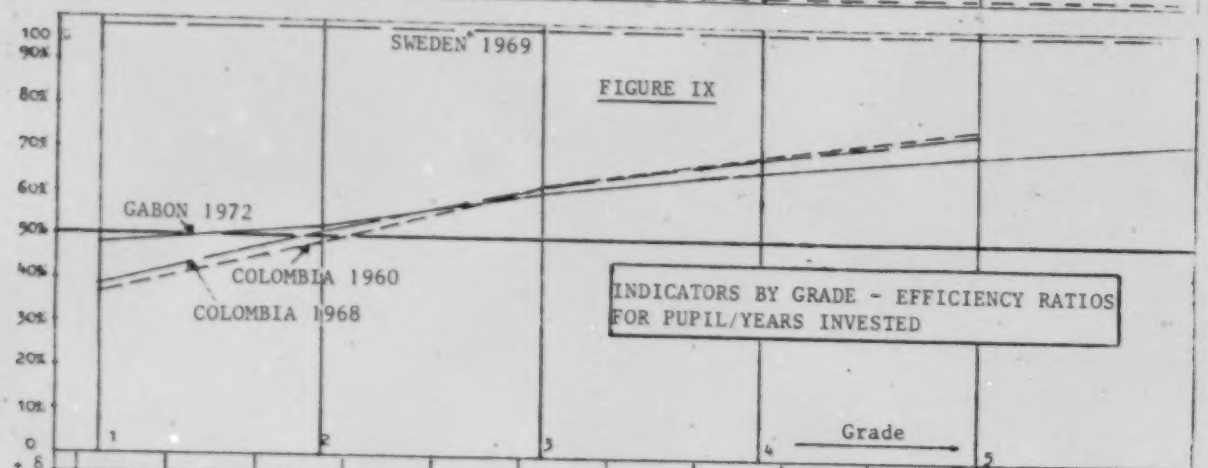


FIGURE IX

INDICATORS BY GRADE - EFFICIENCY RATIOS FOR PUPIL/YEARS INVESTED

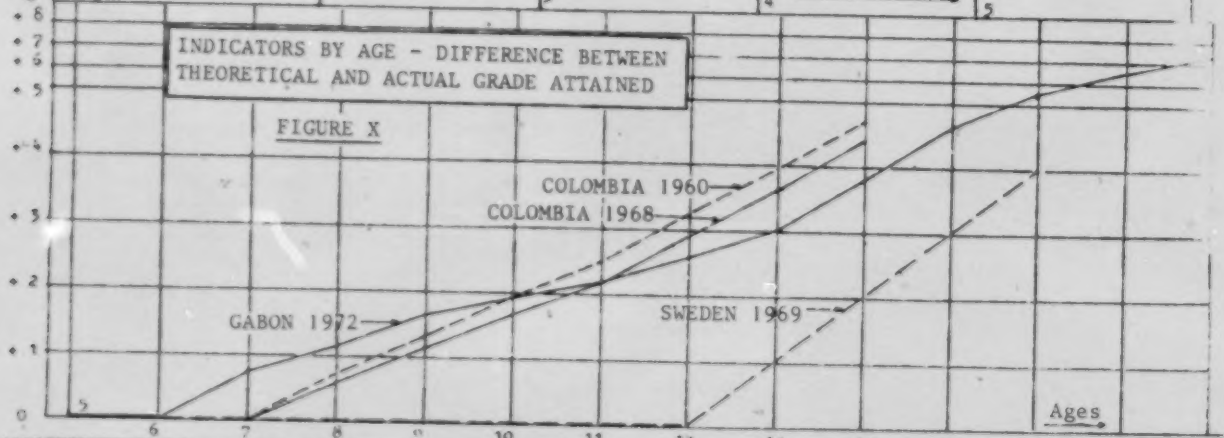


FIGURE X

INDICATORS BY AGE - DIFFERENCE BETWEEN THEORETICAL AND ACTUAL GRADE ATTAINED

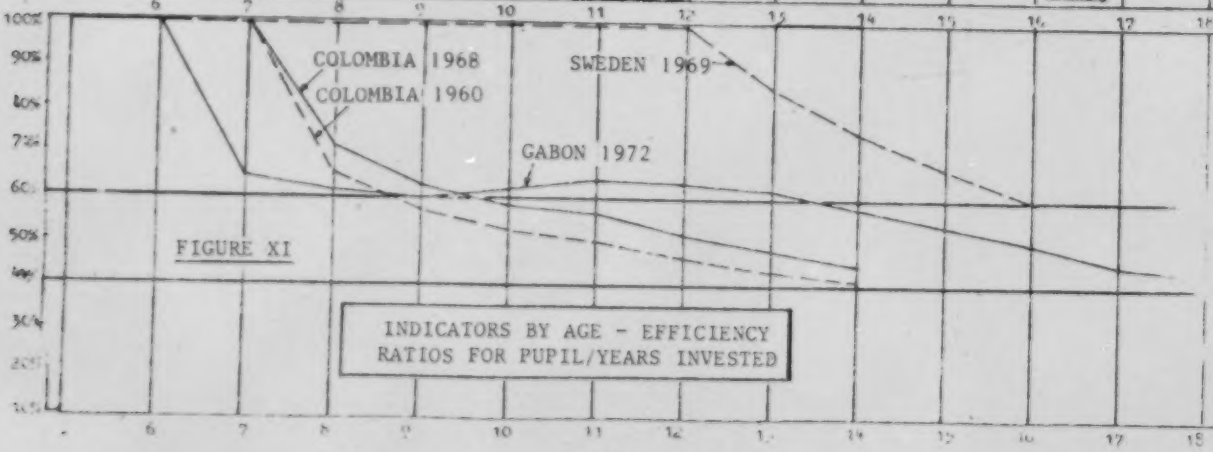


FIGURE XI

INDICATORS BY AGE - EFFICIENCY RATIOS FOR PUPIL/YEARS INVESTED

retardation is very low up to the age of 12 (normal age for the 6th grade). It increases from the age of 13, but pupils aged 13 and over only represent 1% of the total number of pupils studied.

3.5.2. Gabon - 1972

The average retardation increases progressively from one grade to the next, rising to 2.1 years in the 5th and 6th grades. On the other hand, the coefficient of efficiency progressively improves as those pupils with most retardation drop out. On the basis of age, retardation in relation to the theoretical grade increases progressively, whereas the coefficient of efficiency, which is relatively stable around 62% between the ages of 7 and 13, falls away rapidly in the higher age groups (pupils aged 12 and over account for 24.3% of the total).

3.5.3. Colombia - 1960 and 1968

On the basis of grades, average cumulative retardation reaches a peak in the 2nd grade, and falls off slightly until the 5th grade. This applies to each of the 2 school years concerned, although there is a slight drop between 1960 and 1968, i.e. an average of 1.74 as against 1.84. Although the coefficient of efficiency improved slightly between 1960 and 1968 (an average of 56.8% as against 52.3%), it will be seen that this improvement was restricted to the first three grades. On the basis of age, a slight improvement in efficiency is noticeable between 1960 and 1968, in terms of pupil-years invested, accompanied by a slight increase in the scholastic level attained in each age group. A progressive reduction in the coefficient of efficiency is also evident in relation to age, and this is true for each of the school years concerned (pupils aged 12 and over accounted for 23.5% of the total in 1960 and 27% in 1968).

TABLE XV - ESTIMATED DURATION OF EDUCATION ACCORDING TO AGE AND GRADE - PRIMARY EDUCATION - LIBREVILLE - GABON - 1972

Ages	CP1		CP2		CE1		CE2		CM1		CM2		Total Enrolment	Theoretical pupil/years	Observed pupil/years
	Pupils	p/y	Pupils	p/y	Pupils	p/y	Pupils	p/y	Pupils	p/y	Pupils	p/y			
5 years	90	90	-	-	-	-	-	-	-	-	-	-	90	90	90
6 years	2,220	2,220	70	140	2	6	-	-	-	-	-	-	2,292	2,366	2,366
7 years	1,584	3,168	655	1,310	75	225	-	-	-	-	-	-	2,314	3,119	4,703
8 years	566	1,698	858	2,544	446	1,338	40	160	-	-	-	-	1,910	3,780	5,770
9 years	196	784	611	2,444	610	2,440	265	1,060	32	160	6	36	1,720	4,504	6,924
10 years	63	315	306	1,530	529	2,645	443	2,215	222	1,110	27	162	1,590	5,306	7,977
11 years	25	150	128	768	274	1,644	379	2,274	318	1,908	149	894	1,273	5,103	7,638
12 years	7	49	34	238	163	1,141	347	2,429	411	2,877	339	2,373	1,301	6,041	9,107
13 years	1	8	11	88	73	584	153	1,224	356	2,848	514	4,112	1,108	5,718	8,864
14 years	1	9	2	18	16	144	40	360	141	1,269	409	3,681	609	3,372	5,481
15 years	-	-	-	-	6	60	10	100	68	680	211	2,110	295	1,664	2,950
16 years	-	-	-	-	-	-	-	-	6	66	44	484	50	294	550
17 years	-	-	-	-	-	-	-	-	2	24	2	24	4	22	48
Total enrolment	4,753	-	2,675	-	2,194	-	1,677	-	1,556	-	1,701	-	14,556	-	-
Theoretical pupil/years	-	4,753	-	5,350	-	6,582	-	6,708	-	7,780	-	10,206	-	41,379	-
Estimated pupil/years	-	8,491	-	9,110	-	10,227	-	9,822	-	10,942	-	13,876	-	-	62,468

TABLE XVI - INDICATORS BY GRADE - GABON - 1972

	CP_1	CP_2	CE_1	CE_2	CM_1	CM_2	Total & Average
Total enrolment	4.753	2.675	2.194	1.677	1.556	1.701	14.556
Theoretical p/y	4.753	5.350	6.582	6.708	7.780	10.206	41.379
Invested pupil/years	8.491	9.110	10.227	9.822	10.942	13.876	62.468
Average duration	1,79	3,41	4,66	5,86	7,03	8,16	4,29
Theoretical duration	1	2	3	4	5	6	2,84
Average accumulated delay	0,79	1,41	1,66	1,86	2,03	2,16	1,45
$\frac{\text{Invested p/y}}{\text{Theoretical p/y}}$	1,79	1,70	1,55	1,46	1,41	1,36	1,51
Efficiency ratio	56,0 %	58,8 %	64,4 %	68,3 %	71,1 %	73,6 %	66,2 %

TABLE XVII - INDICATORS BY AGE - GABON - 1972

	5	6	7	8	9	10	11	12	13	14	15	16	17	All ages
Total enrolment	90	2.292	2.314	1.910	1.720	1.590	1.273	1.301	1.108	609	295	50	4	14.556
Theoretical p/y	90	2.366	3.119	3.780	4.504	5.306	5.103	6.041	5.718	3.372	1.664	294	22	41.379
Estimated pupil/years	90	2.366	4.703	5.770	6.924	7.977	7.638	9.107	8.864	5.481	2.950	550	48	62.468
Theoretical grade*	1	1,03	2,03	3,02	4,02	5,02	6,00	7,00	8,00	9,00	10,00	11,00	12,00	4,29
Attained grade	1	1,03	1,35	1,98	2,62	3,34	4,01	4,64	5,16	5,54	5,64	5,88	5,50	2,84
Difference	-	-	0,68	1,04	1,40	1,68	1,99	2,36	2,84	3,46	4,36	5,12	6,50	1,45
Invested p/y / Theoretical p/y	1	1	1,50	1,50	1,50	1,50	1,50	1,50	1,60	1,60	1,80	1,90	2,20	1,51
Efficiency ratio	100,0	100,0	66,00	66,00	65,00	67,00	67,00	66,00	65,00	62,00	56,00	53,00	46,00	66,00

* Although the 6th grade is the highest in primary education, hypothetically we have indicated to the 12th grade in order to illustrate the importance of delay accumulated.

TABLE XVIII - VARIATION IN THE INDICATOR OF EFFICIENCY ACCORDING TO THE RELATIVE IMPORTANCE OF LATE ENTRANCE

Proportion of delayed pupils (%)	Enrolment	Invested pupil/years	Indicator of efficiency	Weight of years repeated
0	-	62.468	66,24	33,76
10	1.456	61.012	67,82	32,18
20	2.911	59.557	69,47	30,53
30	4.367	58.101	71,21	28,79
40	5.822	56.646	73,04	26,96
50	7.278	55.190	74,97	25,03
60	8.734	53.734	77,00	23,00

TABLE XIX - INDICATORS BY GRADE - SWEDEN - 1969

	1	2	3	4	5	6	Total & average
Total enrolment	107.842	105.182	102.480	104.487	104.109	107.167	631.267
Theoretical p/y	107.842	210.364	307.440	417.948	520.545	643.002	2.207.141
Invested pupil/years	109.868	213.616	311.726	422.699	525.794	649.479	2.233.182
Average duration	1,02	2,03	3,04	4,05	5,05	6,06	3,54
Theoretical duration	1	2	3	4	5	6	3,50
Average accumulated delay	-	0,03	0,04	0,05	0,05	0,06	0,04
Invested p/y / Theoretical p/y	1,02	1,02	1,01	1,01	1,01	1,01	1,01
Efficiency ratio	98,16	98,48	98,63	98,88	99,00	99,00	98,83

TABLE XX - INDICATORS BY AGE - SWEDEN - 1969

	- de 7	7	8	9	10	11	12	13	14	15	16	All ages
Total enrolment	1.492	105.976	103.943	101.505	104.056	103.835	104.146	6.027	269	17	1	631.267
Theoretical grade	1	1,02	2,02	3,02	4,02	5,02	6	7	8	9	10	3,54
Estimated grade	1	1,02	2,00	2,98	3,98	4,97	5,95	5,98	6	6	6	3,50
Difference	-	-	0,02	0,04	0,04	0,05	0,05	1,02	2,00	3,00	4,00	0,04
Theoretical grade / Estimated grade	1	1	1,01	1,01	1,01	1,01	1,01	1,17	1,33	1,50	1,67	1,01
Efficiency ratio	100,0	100,0	99,00	99,00	99,00	99,00	99,00	85,00	75,00	67,00	60,00	98,83

TABLE XXI - INDICATORS BY GRADE - GABON - 1972

	1	2	3	4	5	6	Total & average
Total enrolment	38.460	19.305	16.368	12.226	11.053	13.054	110.466
Theoretical p/y	38.460	38.610	49.104	48.904	55.265	78.324	308.667
Invested pupil/years	80.493	73.743	81.070	73.305	78.512	105.909	493.032
Average duration	2,1	3,8	5,0	6,0	7,1	8,1	4,5
Theoretical duration	1	2	3	4	5	6	2,8
Average accumulated delay	1,1	1,8	2,0	2,0	2,1	2,1	1,7
$\frac{\text{Invested p/y}}{\text{Theoretical p/y}}$	2,1	1,9	1,7	1,5	1,4	1,4	1,6
Efficiency ratio	47,8	52,4	60,6	66,7	70,4	74,0	62,6

TABLE XXII - INDICATORS BY AGE - GABON - 1972

	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	All ages
Total enrolment	1.658	15.445	15.142	14.154	13.456	12.553	11.212	10.400	8.111	5.066	2.361	772	122	6	8	110.466
Theoretical grade	1,02	1,04	2,04	3,04	4,02	5,02	6,00	7,00	8,00	9,00	10,00	11,00	12,00	13,00	14,00	4,50
Estimated grade	1,02	1,04	1,31	1,86	2,40	3,11	3,84	4,43	4,96	5,21	5,38	5,51	5,44	5,67	4,89	2,80
Difference	-	-	0,73	1,18	1,62	1,91	2,16	2,57	3,04	3,79	4,62	5,49	6,56	7,33	9,11	1,00
$\frac{\text{Theoretical grade}}{\text{Estimated grade}}$	1	1	1,56	1,63	1,68	1,62	1,56	1,58	1,61	1,73	1,86	2,00	2,20	2,29	2,87	1,60
Efficiency ratio	100	100	64,3	61,3	59,7	61,9	64,0	63,3	62,0	57,9	53,8	50,1	45,4	43,6	34,8	62,6

TABLE XXIII - INDICATORS BY GRADE - COLOMBIA - 1960 & 1968

	1		2		3		4		5		Total & average	
	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968
Total enrolment	778.914	1.056.066	448.744	659.476	224.197	449.154	142.259	317.862	96.247	250.874	1.690.361	2.733.432
Theoretical p/y	778.914	1.056.066	897.488	1.318.952	672.591	1.347.462	569.036	1.271.448	481.235	1.254.370	3.399.264	6.248.298
Invested pupil/years	2.119.240	2.729.614	1.840.519	2.586.000	1.094.861	2.191.177	818.762	1.840.188	630.933	1.658.315	6.504.315	11.005.077
Average duration	2,72	2,58	4,10	3,92	4,88	4,88	5,76	5,79	6,56	6,61	3,85	4,03
Theoretical duration	1	1	2	2	3	3	4	4	5	5	2,01	2,29
Average accumulated delay	1,72	1,58	2,10	1,92	1,88	1,88	1,76	1,79	1,56	1,61	1,84	1,74
Invested p/y / Theoretical p/y	2,72	2,58	2,05	1,96	1,63	1,63	1,44	1,45	1,31	1,32	1,91	1,76
Efficiency ratio	36,75	38,69	48,76	51,00	61,43	61,49	69,50	69,09	76,27	75,65	52,26	56,78

65

66

TABLE XXI[illegible] - INDICATORS BY AGE - COLOMBIA - 1960 & 1968

	7 years & -		8		9		10		11		12		13		14 years & +		All ages	
	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968
Total enrolment	251.788	423.566	279.827	418.801	273.576	402.947	273.419	408.573	213.847	342.299	198.359	307.632	107.874	202.519	91.671	227.095	1690.361	2733.432
Theoretical grade	1,05	1,09	2,02	2,07	3,02	3,05	4,02	4,04	5,00	5,00	6,00	6,00	7,00	7,00	8,00	8,00	3,85	4,03
Estimated grade	1,05	1,09	1,32	1,48	1,72	1,93	2,10	2,38	2,51	2,83	2,77	3,10	3,05	3,37	3,30	3,59	2,01	2,29
Difference	-	-	0,70	0,59	1,30	1,12	1,92	1,66	2,49	2,17	3,23	2,90	3,95	3,63	4,70	4,41	1,84	1,74
Theoretical grade / Estimated grade	1	1	1,53	1,40	1,75	1,59	1,91	1,70	1,99	1,77	2,16	1,93	2,29	2,08	2,42	2,23	1,91	1,76
Efficiency ratio	100,00	100,00	65,42	71,27	57,00	63,07	52,32	58,77	50,13	56,50	46,20	51,72	43,58	48,14	41,26	44,91	52,26	56,78

ANNEX 1 : DATA

Below is given the following data :

- Distribution of enrolment by age and grade ;
- Percentage distribution by age and grade.

- Sweden : Tables 1 & 2
- Netherlands : Tables 3 & 4
- Colombia : Tables 5 & 6
- Gabon : Tables 7 & 8

§-§-§-§-§-§-§-§-§

TABLE 1 - DISTRIBUTION OF ENROLMENT BY AGE & GRADE - PRIMARY EDUCATION - SWEDEN

Grades / Age	Total enrolment		1st year		2nd year		3rd year		4th year		5th year		6th year	
	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969
TOTAL	681.835	631.267	109.997	107.842	108.427	105.182	108.682	102.480	112.557	104.487	119.329	104.109	122.843	107.167
- 7 years	1.780	1.492	1.775	1.492	5	-	-	-	-	-	-	-	-	-
7 years	105.286	105.976	103.527	104.324	1.755	1.652	4	-	-	-	-	-	-	-
8 years	107.103	103.943	4.595	2.026	100.439	100.278	2.059	1.639	10	-	-	-	-	-
9 years	107.106	101.505	95	-	6.027	3.252	98.813	96.555	2.163	1.698	8	-	-	-
10 years	112.090	104.056	4	-	177	-	7.452	4.286	101.985	98.038	2.458	1.732	14	-
11 years	117.751	103.835	1	-	17	-	311	-	7.926	4.751	106.999	97.271	2.497	1.813
12 years	119.844	104.146	-	-	3	-	32	-	417	-	9.308	4.963	110.084	99.183
13 years	10.160	6.027	-	-	2	-	8	-	40	-	497	143	9.613	5.884
14 years	680	269	-	-	2	-	2	-	14	-	55	-	607	269
15 years	33	17	-	-	-	-	-	-	1	-	4	-	28	17
16 years	2	1	-	-	-	-	1	-	1	-	-	-	-	1

TABLE 2 - AGE STRUCTURE IN EACH GRADE - PRIMARY EDUCATION - SWEDEN

Grades / Age	Total enrolment		1st year		2nd year		3rd year		4th year		5th year		6th year	
	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969	1960	1969
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
- 7 years	0.26	0.24	1.61	1.38	0.01	-	-	-	-	-	-	-	-	-
7 years	15.44	16.80	94.12	96.74	1.62	1.57	-	-	-	-	-	-	-	-
8 years	15.71	16.47	4.18	1.88	92.63	95.34	1.90	1.60	0.01	-	-	-	-	-
9 years	15.71	16.08	0.09	-	5.56	3.09	90.92	94.22	1.92	1.62	0.01	-	-	-
10 years	16.44	16.48	-	-	0.16	-	6.86	4.18	90.61	93.83	2.06	1.66	0.01	-
11 years	17.27	16.45	-	-	0.02	-	0.29	-	7.04	4.55	89.67	93.43	2.03	1.69
12 years	17.58	16.50	-	-	-	-	0.03	-	0.40	-	7.80	4.77	89.61	92.55
13 years	1.50	0.95	-	-	-	-	0.01	-	0.04	-	0.42	0.14	7.82	5.49
14 years	0.10	0.04	-	-	-	-	-	-	0.01	-	0.05	-	0.50	0.25
15 years	0.01	-	-	-	-	-	-	-	-	-	-	-	0.02	0.02
16 years	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Average age	9.63	9.52	7.03	7.00	8.04	8.01	9.06	9.03	10.06	10.03	11.07	11.03	12.07	12.04

TABLE 3 - DISTRIBUTION OF ENROLMENT BY AGE & GRADE - PRIMARY EDUCATION - NETHERLANDS

Grades / Age	Total enrolment		1st year		2nd year		3rd year		4th year		5th year		6th year	
	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968
TOTAL	1,397,828	1,438,831	245,066	262,445	232,854	249,020	231,293	239,524	231,134	240,320	226,943	229,115	223,918	218,407
6 years	164,357	176,122	163,471	175,960	204	162	-	-	-	-	-	-	-	-
7 years	217,943	237,489	75,407	80,920	141,121	156,375	401	194	-	-	-	-	-	-
8 years	215,505	228,082	5,710	5,276	77,642	81,624	130,615	140,903	584	279	-	-	-	-
9 years	216,400	228,085	381	230	12,242	9,843	79,291	82,555	122,770	135,100	769	357	-	-
10 years	209,992	221,910	60	35	1,423	896	17,211	13,863	78,425	83,023	111,157	122,787	715	356
11 years	209,986	217,695	22	15	170	86	3,221	1,774	22,244	17,743	79,212	81,847	104,052	116,230
12 years	116,765	102,792	10	7	40	28	453	175	5,869	2,833	26,735	20,048	82,990	79,701
13 years	38,946	23,284	4	0	10	4	84	48	1,100	332	7,896	3,627	29,613	19,273
14 years	7,733	3,216	1	1	2	2	13	11	141	58	1,156	427	6,375	2,717
15 years	201	156	-	1	0	-	4	1	1	2	18	22	173	130

TABLE 4 - AGE STRUCTURE IN EACH GRADE - PRIMARY EDUCATION - NETHERLANDS

Grades / Age	Total enrolment		1st year		2nd year		3rd year		4th year		5th year		6th year	
	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968	1961	1968
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6 years	11.76	12.24	66.70	67.05	0.09	0.06	-	-	-	-	-	-	-	-
7 years	15.59	16.51	30.77	30.83	60.60	62.80	0.17	0.08	-	-	-	-	-	-
8 years	15.42	15.85	2.33	2.01	33.34	32.78	56.47	58.83	0.25	0.12	-	-	-	-
9 years	15.48	15.85	0.15	0.09	5.26	3.95	34.28	34.47	53.12	56.22	0.34	0.16	-	-
10 years	15.02	15.42	0.02	0.01	0.61	0.36	7.44	5.79	33.93	34.94	48.98	53.59	0.32	0.16
11 years	15.02	15.13	-	-	0.09	0.03	1.39	0.74	9.62	7.38	34.90	35.72	46.47	53.22
12 years	8.35	7.14	-	-	0.02	0.01	0.20	0.07	2.54	1.18	11.78	8.75	37.06	36.49
13 years	2.79	1.62	-	-	-	-	0.04	0.02	0.48	0.14	3.48	1.58	13.22	8.82
14 years	0.55	0.22	-	-	-	-	-	-	0.06	0.02	0.51	0.19	2.85	1.24
15 years	0.01	0.01	-	-	-	-	-	-	-	-	0.01	-	0.08	0.06
Average age	9.02	8.89	6.36	6.35	7.46	7.42	8.54	8.49	9.63	9.54	10.71	10.59	11.72	11.58

TABLE 5 - DISTRIBUTION OF ENROLMENT BY AGE & GRADE - PRIMARY EDUCATION- COLOMBIA

Grades / Age	Total enrolment		1st year		2nd year		3rd year		4th year		5th year	
	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968
TOTAL	1.690.361	2.733.432	778.914	1.056.066	448.744	659.476	224.197	449.154	142.249	317.862	96.247	250.874
7 years	251.788	423.566	237.961	385.253	13.827	38.313	-	-	-	-	-	-
8 years	279.827	418.801	195.979	249.639	76.761	137.897	7.087	31.265	-	-	-	-
9 years	273.576	402.947	127.815	155.634	99.088	143.238	42.355	82.151	4.318	21.924	-	-
10 years	273.419	408.573	94.601	110.282	93.405	124.619	53.389	100.945	26.662	55.133	5.362	17.594
11 years	213.847	342.299	52.137	64.175	66.444	84.117	45.947	83.273	33.412	68.842	15.907	41.892
12 years	198.359	307.632	39.805	44.925	55.736	65.429	39.638	69.092	36.283	69.343	26.897	58.843
13 years	107.874	202.519	16.971	22.636	26.041	34.673	20.832	43.192	22.588	49.268	21.442	52.750
14 years	91.671	227.095	13.645	23.522	17.442	31.190	14.949	39.236	18.996	53.352	26.639	79.795

TABLE 6 - AGE STRUCTURE IN EACH GRADE - PRIMARY EDUCATION - COLOMBIA

Grades / Age	Total enrolment		1st year		2nd year		3rd year		4th year		5th year	
	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968	1960	1968
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
7 years	14.90	15.50	30.55	36.48	3.08	5.81	-	-	-	-	-	-
8 years	16.55	15.32	25.16	23.64	17.11	20.91	3.16	6.96	-	-	-	-
9 years	16.18	14.74	16.41	14.74	22.08	21.72	18.89	48.29	3.03	6.90	-	-
10 years	16.17	14.95	12.14	10.44	20.81	18.90	23.81	22.47	18.74	17.34	5.57	7.01
11 years	12.65	12.52	6.70	6.08	14.81	12.75	20.49	18.54	23.49	21.66	16.53	16.70
12 years	11.73	11.25	5.11	4.25	12.42	9.92	17.68	15.38	25.50	21.81	27.95	23.45
13 years	6.38	7.41	2.18	2.14	5.80	5.26	9.29	9.62	15.88	15.50	22.28	21.03
14 years & +	5.42	8.31	1.75	2.23	3.89	4.73	6.67	8.74	13.35	16.78	27.68	31.81
Average age	9.85	9.99	8.73	8.58	10.08	9.86	10.87	10.81	11.77	11.72	12.61	12.54

TABLE 7 - DISTRIBUTION OF ENROLMENT BY AGE & GRADE - PRIMARY EDUCATION (1972) - GABON

Age \ Grades	Total enrolment	CP_1	CP_2	CE_1	CE_2	CM_1	CM_2
TOTAL	110.466	38.460	19.305	16.368	12.226	11.053	13.054
5 years	1.658	1.627	31	-	-	-	-
6 years	15.445	14.895	517	33	-	-	-
7 years	15.142	11.006	3.622	488	26	-	-
8 years	14.154	5.731	5.172	2.786	430	35	-
9 years	13.456	2.908	4.554	4.010	1.684	266	34
10 years	12.553	1.269	2.710	3.909	2.995	1.374	296
11 years	11.212	581	1.496	2.342	2.940	2.454	1.399
12 years	10.400	296	726	1.584	2.199	2.764	2.831
13 years	8.111	108	309	725	1.135	2.230	3.604
14 years	5.066	27	114	332	570	1.260	2.763
15 years	2.361	8	33	124	199	517	1.480
16 years	772	4	17	28	39	129	555
17 years	122	-	4	5	9	19	85
18 years	6	-	-	-	-	2	4
19 years	8	-	-	2	-	3	3
20 years	-	-	-	-	-	-	-

TABLE 8 - AGE STRUCTURE IN EACH GRADE - PRIMARY EDUCATION (1972) - GABON

Age \ Grades	Total enrolment	CP_1	CP_2	CE_1	CE_2	CM_1	CM_2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0
5 years	1.50	4.23	0.16	-	-	-	-
6 years	13.98	38.73	2.68	0.20	-	-	-
7 years	13.71	28.62	18.76	2.98	0.21	-	-
8 years	12.81	14.90	26.79	17.02	3.52	0.32	-
9 years	12.18	7.56	23.59	24.50	13.77	2.41	0.26
10 years	11.36	3.30	14.04	23.88	24.50	12.43	2.27
11 years	10.15	1.51	7.75	14.31	24.05	22.21	10.72
12 years	9.41	0.77	3.76	9.68	17.99	25.00	21.69
13 years	7.34	0.28	1.60	4.43	9.28	20.17	27.61
14 years	4.59	0.07	0.59	2.03	4.66	11.40	21.16
15 years	2.14	0.02	0.17	0.76	1.63	4.68	11.34
16 years	0.70	0.01	0.09	0.17	0.32	1.17	4.25
17 years	0.11	-	0.02	0.03	0.07	0.17	0.65
18 years	-	-	-	-	-	0.02	0.03
19 years	-	-	-	0.01	-	0.03	0.02
20 years	-	-	-	-	-	-	-

SCHOOL ENROLMENTS AND DEMOGRAPHIC STRUCTURES

D. Blot

If pupils and students are to receive schooling, adults must work, and some adults must be teachers: there is nothing extraordinary about this statement, but it has far-reaching implications.

Let us suppose that we have an over-all enrolment level, expressed for example, as a series of fixed enrolment ratios. As the ratio of adults to young people is greater or smaller, so the share of the national product set aside for schooling will obviously vary - at least if productivity is to remain the same.

In addition, teachers must undergo more or less intensive training. But the number of individuals who have, at any given moment, reached the required educational level depends on the enrolment level attained in the past. Ultimately, the effort needed to provide schooling in different populations for the same number of pupils varies not only according to earlier enrolment levels but also according to the demographic structures of the populations in question. We should like to draw attention to a few points in this connexion.

****

1. There are as yet relatively few statistical data concerning the level of education of any population as a whole and they are difficult to compare between one country and another. We have therefore abandoned the idea of using the available statistics, and have adopted a more theoretical method cross-classifying three enrolment levels with three standard populations, both selected in such a way as to cover very nearly all possible cases.

2. Enrolment levels are represented by three series of enrolment ratios for each five-year age group, as shown in Table I.

Table 1: Enrolment ratios by age group (per cent)

	S_1	S_2	S_3
5 - 9	23,6	47,0	80,8
10 - 14	19,7	62,6	96,8
15 - 19	4,7	16,2	52,5
20 - 24	0,6	1,4	10,4
25 - 29	-	0,2	2,0

These ratios are those of real countries, whose identity is unimportant for our purposes. They correspond to enrolment levels which are low (S_1), medium (S_2) and high (S_3), and they are fairly representative of the majority of existing situations; consequently, S_1 and S_3 do not stand for the extreme situations observed in reality: it would not have been difficult to choose countries with still lower or still higher enrolment rates.

Finally, for the sake of simplicity, we chose ratios for five-year age groups rather than ratios by single years of age, which are theoretically preferable. The conclusions are in any case the same.

3. The demographic structures are those of three stable populations calculated by the United Nations* and having the following parameters:

	Expectation of life at birth (in years)	Gross reproduction rate
P_1	30	3
P_2	50	3
P_3	70.2	1.5

P_1 and P_2 correspond approximately to the demographic structures of the developing countries, which typically show high fertility and high (P_1) or medium (P_2) mortality. P_3 corresponds to the situation of most industrialized countries.

The progression $P_1 - P_2 - P_3$ also represents approximately the historical evolution of most present-day populations.

Tables II and III and Graph I show the distribution by age group and a few important features of these three populations.

---

* The concept of a stable population: application to the study of populations of countries with incomplete demographic statistics (population studies, No. 39) United Nations, 1968.

Table II. Distribution of the total population of both sexes by age group

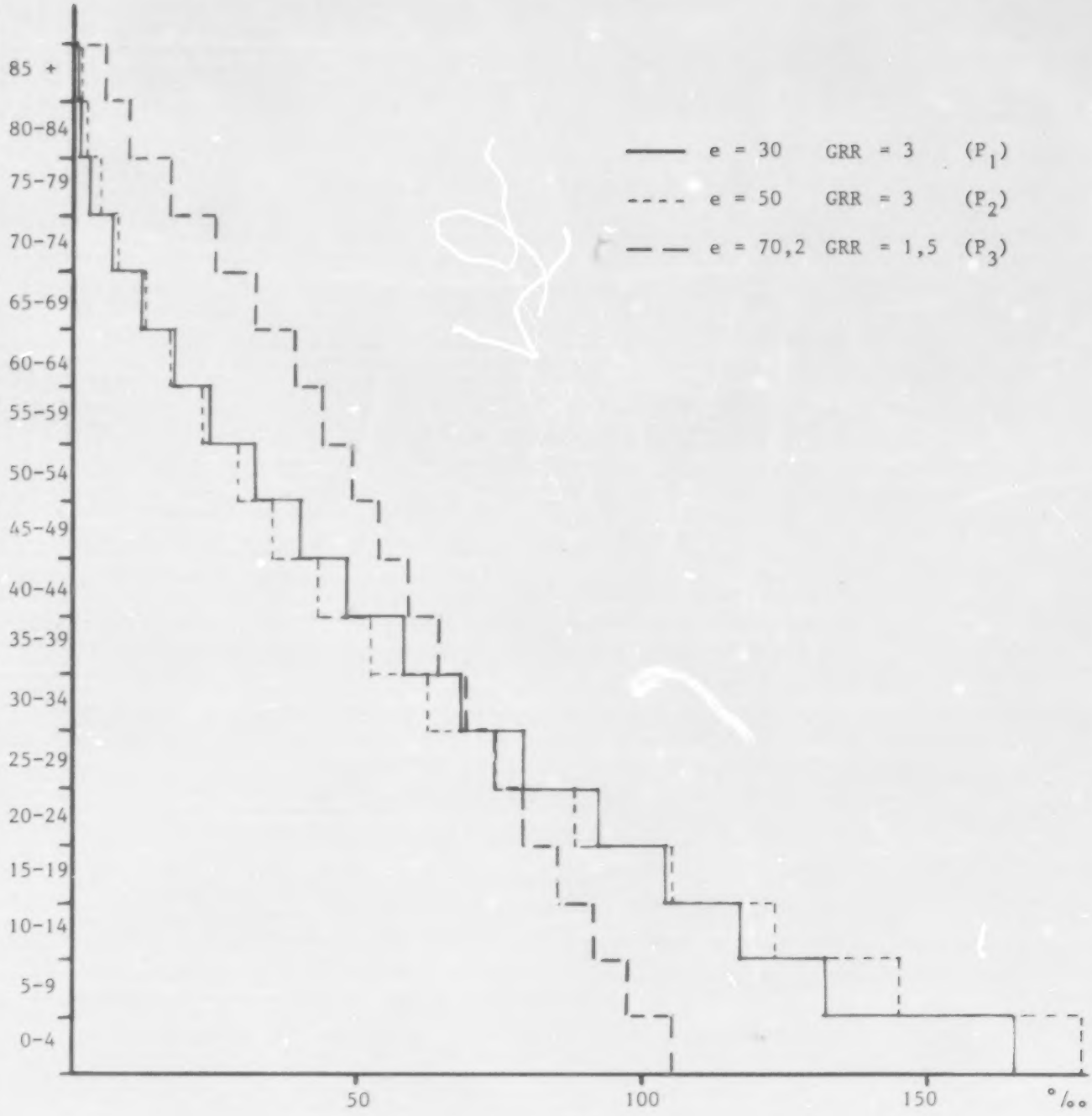
	P_1	P_2	P_3
0 - 4	164 610	177 354	104 792
5 - 9	131 571	144 987	97 417
10 - 14	117 025	123 255	91 034
15 - 19	104 351	104 693	85 005
20 - 24	91 618	88 208	79 237
25 - 29	79 376	73 919	73 778
30 - 34	68 124	61 835	68 626
35 - 39	57 824	51 593	63 726
40 - 44	48 370	42 831	58 979
45 - 49	39 665	35 227	54 243
50 - 54	31 660	28 527	49 369
55 - 59	24 338	22 566	44 240
60 - 64	17 711	17 203	38 645
65 - 69	11 872	12 354	32 340
70 - 74	6 998	8 062	25 193
75 - 79	3 387	4 537	17 496
80 - 84	1 218	2 051	10 187
85+	282	789	5 593
	1 000 000	1 000 000	1 000 000

Source: The Concept of a Stable Population: Application to the Study of Populations of Countries with Incomplete Demographic Statistics (Population Studies, No. 39), United Nations, 1968

Table III Distribution of the total population, both sexes, by broad age groups, gross birth and mortality rates, and natural variations (%)

	P_1	P_2	P_3
Distribution (%)			
Under 15	41.3	44.6	29.3
15 to 59	54.6	50.9	57.7
60 and over	4.1	4.5	13.0
Gross rates (%)			
Birth rate	4.8	4.5	2.2
Mortality rate	3.4	1.6	0.9
Variation	1.4	2.9	1.3

Source: See Table II



89

GRAPH I : Age Pyramid

(based on Table II)

It will be observed that the annual growth rate of the extreme populations P_1 and P_3, are almost the same, but that the distributions by age group are very different.

4. By combining enrolment levels S_1, S_2 and S_3 with population P_1, P_2 and P_3 we obtain nine theoretical enrolment structures. These structures are not all equally realistic. For example, (S_1, P_3) and (S_3, P_1) do not exist, to our knowledge. On the other hand, (S_1, P_1), (S_2, P_2) and (S_3, P_3) are often found. Finally, the main point of the six other combinations is to enable us to see how the results obtained may vary.

5. For each hypothesis, we have begun by calculating the distribution of the population enrolled at school by age group, as well as the proportion of total enrolments, in relation to the total population, on the one hand and to the population aged between 5 and 29 on the other. The results are shown in Table IV.

Table IV. Distribution of the enrolled population by age group and percentage of the enrolled population in relation to the total population and to the population aged between 5 and 29.

	Distribution (%)					Enrolments	
	5-9	10-14	15-19	20-24	25-29	Percentage of the total population	Percentage of the 5 - 29 age group
			Low enrolment level (S_1)				
P_1	52.2	38.7	8.2	0.9	-	6.0	11.4
P_2	53.5	38.0	7.7	0.8	-	6.4	12.0
P_3	50.7	39.5	8.8	1.0	-	4.5	10.6
			Medium enrolment level (S_2)				
P_1	40.3	47.8	11.0	0.8	0.1	15.3	29.3
P_2	41.6	47.1	10.4	0.8	0.1	16.4	30.6
P_3	38.9	48.4	11.7	0.9	0.1	11.8	27.6
			High enrolment level (S_3)				
P_1	37.2	39.7	19.2	3.3	0.6	28.5	54.5
P_2	38.8	39.5	18.2	3.0	0.5	30.2	56.5
P_3	35.6	39.8	20.2	3.7	0.7	22.1	51.9

For a given enrolment level, there is little difference in the distribution of enrolments. On the other hand, the global figures, to the right of the table, vary much more markedly, in particular school enrolments expressed as a percentage of the total population. One can thus see the drawback of using enrolment ratios which are excessively aggregated, as is often done, for lack of available ratios by single years of age.

Let us take, for example, countries A and B, which show combinations (S_2, P_2) and (S_3, P_3) respectively. The rate calculated in relation to the total population is 35 per cent higher in country B (22.1/16.4 = 1.35) in relation to the 5 - 29 age group, it is 70 per cent higher (51.9/30.6 = 1.70). But in reality, these percentages are influenced by the different demographic structures of the two countries*. To eliminate this effect one is obliged to calculate the rates on the basis of an invariable demographic structure, for example, that of country A or that of country B. If the demographic structure of country A is used, the comparison is between (S_2, P_2) and (S_3, P_2) and if the demographic structure of country B is used, the comparison is between (S_2, P_3) and (S_3, P_3). The difference between the percentage will be found to be roughly similar (between 84 and 88 per cent).**

6. Table V shows school enrolments per 100 adults aged between 15 and 29 years.

Table V. School enrolments per 100 adults aged between 15 and 59

	P_1	P_2	P_3
S_1	11	13	8
S_2	28	32	20
S_3	52	59	38

---

* The population aged between 5 and 29 expressed as a percentage of the total population is 52.4 per cent for P_1, 53.5 per cent for P_2 and 42.6 per cent for P_3.

** One may take as a reference an even more simple demographic structure: one in which there are equal numbers in all age groups. In this case one needs only compare the totals of rates S_2 and S_3: the difference between these totals is 40 per cent.

We are using this adult population as a very rough and ready substitute for the working population, so as to avoid introducing additional hypotheses. It is interesting to note that, for each enrolment hypothesis, the highest number of adults is to be found in population P_2. This observation - and it has been made before* - shows that a reduction in mortality which is not accompanied by a reduction in fertility increases the burden on adults: this is so because it is in population P_2 that the proportion of adults is lowest (cf. Table III).

7. We can now tackle the problem from another angle. The entire adult population helps to determine the share of the national product to be channelled into the education system, but the necessary teachers can be recruited only from a population educated to a certain standard.

Let us suppose that the enrolment rates S_1, S_2 and S_3 are constant in time. If this is so, they represent the school career of a given cohort. Let us take, for example, the upper hypothesis, S_1. In the cohort aged between 5 and 9 there are 80.8 per cent of enrolled pupils, and five years later, in the same cohort, now aged between 10 and 14, there are 96.8 per cent of enrolled pupils. We shall suppose in this case that no pupil has yet left school. Moving on another five years, still in the same cohort, now aged between 15 and 19, there are 52.5 per cent of enrolled pupils: we shall suppose that 45 per cent (96.8 - 52.5 = 44.3) of pupils have stopped attending school between the ages of 15 and 19. Furthermore, the difference between 100 per cent and the ratio of the highest series, i.e. in this case 3.2 per cent (100 - 96.8 = 3.2) represents the fraction of each cohort which has never been enrolled at school. Lastly, on the supposition that mortality does not depend on enrolment level, we now have all the information required to work out, on the basis of the rates shown in Table I, the enrolment history of the entire population. This enrolment history is shown in Table VI.

The hypotheses introduced are obviously very rough and ready, and sometimes even inaccurate (for example, mortality independent of educational level). However, they should give the reader an idea of the upper limit of the educational level attained in each population.**

---

* Cf. for example: The aging of populations and its economic and social implications. (Population studies, No. 26,), United Nations, 1956. See in particular pp. 61 et seq., where the calculation takes hypotheses on the active population into account.

** It is indeed an upper limit, since enrolment ratios normally tend to increase in time, so that taking them to be constant amounts to overestimating the educational level corresponding to each enrolment hypothesis.

Table VI. Distribution of the population by school-leaving age (%)

	not enrolled	10 - 14 years	15 - 19 years	20 - 24 years	25 - 29 years	over 29 years
			Low enrolment (S_1)			
0 - 4	100.0					
5 - 9	76.4	(23.6)				
10 - 14	76.4	3.9	(19.7)			
15 - 19	76.4	3.9	15.0	(4.7)		
20 - 24	76.4	3.9	15.0	4.1	(0.6)	
25 - 29	76.4	3.9	15.0	4.1	0.6	-
30 and over	76.4	3.9	15.0	4.1	0.6	-
			Medium enrolment (S_2)			
0 - 4	100.0					
5 - 9	53.0	(47.0)				
10 - 14	37.4	-	(62.6)			
15 - 19	37.4	-	46.4	(16.2)		
20 - 24	37.4	-	46.4	14.8	(1.4)	
25 - 29	37.4	-	46.4	14.8	1.2	(0.2)
30 and over	37.4	-	46.4	14.8	1.2	0.2
			High enrolment (S_3)			
0 - 4	100.0					
5 - 9	19.2	(80.8)				
10 - 14	3.2	-	(96.8)			
15 - 19	3.2	-	44.3	(52.5)		
20 - 24	3.2	-	44.3	42.1	(10.4)	
25 - 29	3.2	-	44.3	42.1	8.4	(2.0)
30 and over	3.2	-	44.3	42.1	8.4	2.0

Note: The percentages in brackets correspond to the enrolments in each age group shown on the left.

8. By using the percentages in Table VI, it is possible to classify, by educational level, the totals of each age group corresponding to the three demographic hypotheses in Table II. Table VII shows the distribution by educational level of the adult population not enrolled at school, aged between 15 and 59.

Table VII. Distribution of the population not enrolled at school aged between 15 and 59, by educational level (%)

	N_1	N_2	N_3
	Low enrolment (S_1)		
P_1	81.1	15.2	3.7
P_2	81.2	15.1	3.7
P_3	80.9	15.1	4.0
	Medium enrolment (S_2)		
P_1	38.7	48.0	13.3
P_2	38.8	48.1	13.1
P_3	38.4	47.6	14.0
	High enrolment (S_3)		
P_1	3.6	50.4	46.0
P_2	3.7	50.8	45.5
P_3	3.5	48.9	47.6

The levels are grouped as follows:

N_1 : Population not attending school and population having left school before the age of 15

N_2 : Population having left school between the ages of 15 and 19

N_3 : Population having left school after the age of 19.

By and large, N_1 corresponds to primary or lower education level, N_2 to secondary level and N_3 to post-secondary and higher level.

It will be seen that the percentages in Table VII differ very little from one hypothesis to another, which is logical, since here the demographic structure is relevant only for school-age classes.

9. Let us suppose that most teachers are recruited from the adult population at level N_3; Table VIII shows the enrolments per 100 adults at this level. This table should therefore be compared with Table V.

Table VIII. Enrolments for every 100 non-enrolled adults aged between 15 and 59 at level N_3

	P_1	P_2	P_3
S_1	295	346	200
S_2	219	255	150
S_3	130	150	89

This shows that population P_2 once again bears the heaviest burden.

10. Let us suppose, lastly, that one teacher is needed for every 30 pupils.* One may now calculate the percentage of teachers needed in relation to the adult population and in relation to the fraction of that population at level N_3 (all one has to do is to divide the figures in Tables V and VIII by 3); one thus obtains the percentages set out in Table IX.

Table IX. Percentage of teachers needed (one teacher to 30 pupils).

	P_1	P_2	P_3
Percentage of the total adult population			
S_1	0.4	0.4	0.3
S_2	0.9	1.1	0.7
S_3	1.7	2.0	1.3
Percentage of the adult population at level N_3			
S_1	9.8	11.5	6.7
S_2	7.3	8.5	5.0
S_3	4.3	5.0	3.0

in which the advantage of (S_3, P_3) stands out sharply in comparison with (S_1,P_1) and (S_2,P_2).

* In 1970, there was approximately one teacher to every 20 pupils in the developed countries and one to every 29 pupils in the developing countries, i.e., on average, one teacher to 24 pupils (cf. Unesco Statistical Yearbook, 1972, pp. 68 69)

The figures reached as a result of the foregoing analysis are, of course, very rough estimates, and, moreover, the evolution in time of demographic and enrolment phenomena is not taken into account. There is no doubt, however - as experience over the past few years has shown - that school enrolments rise much more rapidly than the educational level required to provide schooling. This adds still more to the burden borne by adults, educated or otherwise.

This is unquestionably one of the major difficulties encountered by countries seeking to develop their education system, which they consider inadequate, particularly as regards recruitment of indigenous teachers - all the more so since these countries are also in what seems to be the most dangerous of demographic situations: they are experiencing a drop in mortality which is not offset by a sufficient drop in fertility.

EMPLOYING ENROLMENT RATIOS AND INTAKE RATES FOR DEVELOPING COUNTRIES: PROBLEMS AND SHORTCOMINGS

B. Fredriksen

During the past few years the Unesco Office of Statistics has collected through questionnaires, national publications and field missions a considerable amount of data on the age-distribution of the pupils enrolled at school in its Member States. These data have permitted analyses of several aspects of enrolment in relation to the age-structure of the pupils. Such analyses are particularly relevant to developing countries where late entry and repetition lead to a wide age-range in each grade.

In addition to the purely pedagogical problems that a wide age span within a class might present to the teacher, this phenomenon presents special analytical problems to educational statisticians and planners. Two aspects of this problem are treated in this article. The first concerns the use of enrolment ratios as measures of school participation in countries where the enrolment in a particular educational level or grade includes a large number of pupils outside the age-range which, according to national regulations, should be enrolled in this level or grade. The first part of the article defines various types of enrolment ratios and discusses their use under these circumstances. The second part discusses some problems involved in projecting the future number of new entrants to the school system for countries where new entrants come from several age-groups. The problems studied are in both cases illustrated for selected countries by the use of data on enrolment and new entrants by age. The countries included have been selected on the base of data availability.

1. The use of enrolment ratios as measures of school enrolment

An enrolment ratio is defined as the ratio between the number of pupils enrolled in a given age-group or level of education and the size of the population in a given age-group. Hence, enrolment ratios are only relative measures of numbers enrolled and the interpretation of such ratios varies with the pupils and the population being considered. For example, enrolment ratios may be calculated by level of education or without regard to level, they may take into account the age of the pupils or disregard the age. Enrolment ratios may furthermore be calculated separately for boys and girls, for part-time and full-time education, private and public schools, urban and rural education, ethnic groups, etc. The population data used in the denominator and the enrolment data used in the numerator both refer to the same point in time. In practice this may create problems since population estimates may refer, for example, to the middle of the calendar year while the enrolment data may refer to the beginning of the school year.

The purpose of this section is to describe those enrolment ratios most commonly used and to indicate the data required for calculation. The reader should be aware that there is not a clear terminology in this area. The terms used here are believed to be the ones most commonly used[1].

1) See for example:
- Kendall, W. L.: Statistics of Education in Developing Countries, Statistical Reports and Studies, Unesco, Paris 1968.
- The Methods and Materials of Demography, U.S. Department of Commerce, Bureau of the Census, Washington 1971, pp. 317-320.

1.1 Overall enrolment ratios

It is expedient to start by discussing the "overall" enrolment ratio (also referred to as the crude or general enrolment ratio) which is the least refined of these ratios, in order to illustrate the reasons for developing more refined and detailed measures. The overall enrolment ratio is equal to the total enrolment at all levels of education divided by those ages of the population which corresponds to the normal age-range, for example the age-group 6 - 24 years. This ratio gives an approximate idea as to the extent of enrolment among the population of school age, but is not an adequate measure for detailed studies of enrolment developments. Comparisons of the level of enrolment either between countries or over time for one single country, based upon crude enrolment ratios have two major weaknesses: they do not give any information concerning the age of the pupils or level at which they are enrolled, and they are influenced by changes in the age-distribution of the population. The latter factor implies that international comparisons based on the crude enrolment ratio may be misleading since the age-distribution may differ significantly between countries. Caution must also be exercised in interpreting trends in such ratios within a given country since they are influenced by modifications in the age-distribution of the population. Thus, a shift towards a more youthful population can, even if the proportion of children enrolled in each individual age-group remains constant, increase the overall enrolment ratio by placing more persons in the typical enrolment ages. This would create a false impression of a change in the pattern of enrolment. It should be noted that all enrolment ratios calculated for aggregated age-groups would be influenced by changes in the age-distribution of the population, as long as the enrolment ratios by single years of age differ between ages. This is because any enrolment ratio covering several ages is a weighted average of the enrolment ratios by single year of age for the ages covered, the weight being the population in each single age. We shall discuss this in more detail under points 1.3 and 1.4 below.

The seriousness of the limitations listed above depends on the purpose for which the enrolment ratio is used. Several refinements are possible depending on the type of data available and the problem to be illustrated. Problems related to changes in the age-distribution of population and enrolment required data on enrolment by age, while problems related to the level of the pupils enrolled require data on enrolment by level of education. Based on such data, age-specific or level-specific enrolment ratios may be calculated. These ratios will be discussed below.

1.2 Level enrolment ratios

The most commonly used enrolment ratio is probably the level enrolment ratio also called the level-specific enrolment ratio, and often referred to as the enrolment ratio for primary, secondary or higher education. This ratio may be expressed as:

$$(1)\quad \frac{E_h^t}{P_a^t} \times 100$$

where E_h^t = Enrolment at school level h year t, where h refers to primary, secondary or higher education

P_a^t = Population in age-group a, year t.

The numerator in each case would refer to total enrolment at a given level while the denominator would refer to the population which, according to national regulations, should be enrolled at this same level. As the numerator includes all pupils enrolled regardless of age, the enrolment ratio defined by (1) is also referred to as the gross level enrolment ratio. This is in contrast to the net level enrolment ratio (also referred to as the age-level specific enrolment ratio) which

includes the same age-group in numerator and denominator:

(2) $\frac{E^t_{h,a}}{P^t_a} \times 100$ where $E^t_{h,a}$ = enrolment at level h in age-group a, year t.

For example, for a country where the official age of admission to primary education is six and the duration of primary education is six years, the denominator would include the population aged 6 - 11 years for both the gross and net enrolment ratios for primary education. The numerator of the gross enrolment ratio would however include all pupils in primary education while the net enrolment ratio would include only those belonging to the age-group 6 - 11[1]. Note that the gross enrolment ratio can exceed 100, while the net enrolment ratio has 100 as its maximum value. The difference between the gross and net ratios for a given level is an indicator of the importance of under- and over-aged pupils enrolled at this level. We shall discuss this more thoroughly below.

Tabulations showing gross level enrolment ratios for countries with differing educational structures often employ the term adjusted enrolment ratio. This means that the age-range of the population used in the denominator of the enrolment ratio for a given level, has been adjusted for each country to the prescribed duration of this level. For example, while the population aged 6 - 11 would be used for a country where the official admission age is six and the duration of primary education is six years, the population aged 7 - 13 years would be used for a country where the official admission age is seven and the duration is seven years[2]. Before population data by single years of age became available on an international scale, unadjusted enrolment ratios were used. These were obtained for all countries by dividing the enrolment at a given level by the same population age-group without taking into account the differences between countries of length of schooling and entry age[3].

The use of gross level enrolment ratios calculated separately for primary, secondary and higher education represent a major improvement as compared to the use of overall enrolment ratios for measuring changes in enrolment either over time for a given country or for international comparisons. This is particularly true in developed countries where almost all new entrants start school at the official entry age and where repetition is relatively low leading to very few under- and over-aged pupils. Under these circumstances the gross level enrolment ratio gives reasonable measurement of the educational coverage at the level in question, relative to the size of the age-group which according to national regulations should be enrolled at this level. In developing countries on the other hand, there is a wide age-spread in the enrolment at any given level, due to a large amount of late entrants and repetition. In these countries therefore the difference between the gross and net level enrolment ratios is often considerable. Neither of them gives precise information concerning the educational coverage at a particular level measured relatively to the size of the relevant age-group in the population. The net level enrolment ratio gives only a partial picture, since it excludes those pupils outside the official age-group, while the gross level enrolment ratio gives an ambiguous and often overstated measure since its

1) Table 2.7 of the 1972 Unesco Statistical Yearbook gives gross and net enrolment ratios for primary and secondary education for the countries for which data on enrolment by age were available.

2) The gross enrolment ratios shown in Table 2.7 of the 1972 Unesco Statistical Yearbook were calculated in this manner.

3) Such ratios are published, for example, in Table 2.5 of the 1968 Unesco Statistical Yearbook.

numerator and denominator do not refer to the same ages. The problem involved in using this latter ratio is to find the appropriate age-group against which to measure the recorded enrolment. This problem is best appreciated by first considering age-specific enrolment ratios.

1.3 Age-specific enrolment ratios

Age-specific enrolment ratios relate the enrolment of a given age or age-group in a given year to the population of the same age in the same year and may be defined as:

$$(3) \qquad \frac{E_a^t}{P_a^t}$$

where the symbols are defined above.

The age-specific enrolment ratio is the sum of the age-level specific enrolment ratios as defined by (2). This may be seen from the following expression:

$$(4) \qquad \frac{E_a^t}{P_a^t} = \frac{E_{P,a}^t}{P_a^t} + \frac{E_{S,a}^t}{P_a^t} + \frac{E_{H,a}^t}{P_a^t}$$

where P, S and H refer to primary, secondary and higher education respectively.

The age-specific enrolment ratios may be calculated by single years of age or by age-groups. In both cases the problem of under- and over-aged pupils is eliminated since the numerator and denominator refer to the same age or age-group. It should however be noted that only age-specific enrolment ratios calculated by single years of age are not affected by changes in the age-structure of the population. Thus, a shift towards a more youthful population can increase an age-specific enrolment ratio calculated for an age-group, by placing more persons in the typical enrolment ages, even if all the enrolment ratios by single years of age remain unchanged. Likewise, a decline in the birth-rate leading to a shift towards an "older" population might lead to a decrease in an age-specific enrolment ratio calculated for an age-group, by giving higher relative weights to the ages having a relatively low school participation. This may happen even if all the enrolment ratios by single years of age were to increase. Such shifts took place, for example, in many European countries after the Second World War as a consequence of the postwar "baby boom". In such cases only enrolment ratios by single years of age give a correct account of the change in enrolment over time. It is often desirable however to work with some aggregated measure of enrolment and not with enrolment ratios by single years of age. Such a measure may be obtained by calculating standardized enrolment ratios as shown below.

1.4 Standardized enrolment ratios

The enrolment ratio for a given age-group may be "standardized" to take into account the age-distribution of the population within this age-group. An adjustment of this type is sometimes preferable if the ratio is used to compare the level of enrolment either for two different populations at one point in time, or for the same population at different points in time. What may appear to be differences or changes in enrolment when studying the age-specific enrolment ratio comprising several ages, may partly or wholly be a function of differences or changes in the age-structure of the population within this age-group. The purpose of the standardized enrolment ratio is to eliminate such effects. Standardized enrolment ratios may be used for comparing enrolment between different

regions within a country, between ethnic groups, urban-rural residence or between girls and boys.

The age-standardized enrolment ratio may be expressed as:

$$(5) \quad \sum_{a} \frac{\frac{E_a}{P_a} \times P_{sa}}{P_s}$$

where E_a = Enrolment in age-group a
P_a = Population in age-group a
P_{sa} = Standard population in age-group a
P_s = Total standard population

In other words, the standardized enrolment ratio is obtained by computing the weighted average of the enrolment ratios by single years of age for a given population, using as weights the age-distribution of the standard population. Thus, if we wanted to compare the enrolment ratios of urban and rural areas for a given age-group, this could be done by computing the weighted average of the enrolment ratios by single years of age for the rural population, using as weights the age-distribution of the urban population. This would show what the enrolment ratio for this age-group would have been in rural areas if the age-structure of the rural population had been the same as that of the urban population. This standardized ratio for rural areas may then be compared with the enrolment ratio for urban areas. Any difference between these two ratios would be caused by differences in the enrolment pattern and not by differences in the age-structure of the two populations.

In the above example, the urban population was used as the standard population. We could as easily have chosen the rural population or an average of the two. Similarly, if the purpose is to compare the development of enrolment over time for one given population, the standard population may be the population at the beginning of the period, the end of the period or an average of the two. If comparisons are made of enrolment ratios pertaining to different regions within one country, the total population may be used as the standard. It should be noted however that different results will be obtained for the relative difference between adjusted ratios, depending on the age-distribution selected as a standard (this is illustrated in the example below). The choice of standard may even affect the direction of the difference between the ratios for the populations being compared. Thus, it is necessary to select the standard population carefully. In general, the standard population should be one with an age-distribution similar to those of the populations being studied. If the purpose is to compare the level of enrolment of two sub-populations (e.g., the urban and the rural population) the best result may well be achieved by using the (unweighted) average of these two sub-populations as a standard. Similarly, when comparing development of enrolment over time for one given population, use of the age-distribution for the first or last year of the period should be avoided. In some cases the differences in the age-distribution between two populations may be so large that is would perhaps be desirable to forego comparisons based on summary measures, such as the standardized ratio, and instead use enrolment ratios by single years of age.

It is important to recognize the fact that age-standardized enrolment ratios have no direct meaning in themselves. They are only useful for comparisons. The procedure consists of computing such ratios for those population groups where enrolments are to be compared and to calculate the relative differences between the resulting ratios. These differences may then be compared provided the ratios are based on the same standard population.

We shall illustrate below how a standardized enrolment ratio may be used for analyzing the development of enrolment over time using data for 1958 and 1968 for France. Table 1 shows the enrolment ratios by single years of age for these two years. The last column of the table gives the age-specific enrolment ratios for the age-group 6 - 17 years.

TABLE 1 - Age-specific enrolment ratios for 1958 and 1968 (France).

Year \ Age	6	7	8	9	10	11	12	13	14	15	16	17	6-17
1958	97.9	100.0	98.6	97.4	99.3	99.3	97.9	95.6	68.1	52.4	43.2	26.2	85.5
1968	98.6	99.5	99.4	98.0	97.9	96.9	97.5	96.6	86.5	74.3	55.6	39.7	86.7

It is interesting to note that with the exception of the ages 7, 10, 11 and 12 years, all the enrolment ratios are larger in 1968 than in 1958, particularly for pupils aged 14 years and above. In spite of this the age-specific enrolment ratio for the age-group 6 - 17 years is only slightly higher in 1968 than in 1958. Thus, if we limit ourselves to consider only this latter ratio, we might conclude that the pattern enrolment of children aged 6 - 17 did not increase much in France during the period studied. The enrolment ratios by single years of age however show a considerable increase in enrolment of pupils aged 14, 15, 16 and 17 years during this period. These changes are not reflected by a corresponding change in the enrolment ratio for the age-group 6 - 17 as a whole, because of the considerable changes taking place in the age-structure of the population in this age-group between 1958 and 1968. In 1958, 57.6% of the population in the age-group 6 - 17 years was aged 6 - 11 years while the corresponding figure in 1968 was 42.7%. Thus, there was a shift towards an "older" population, i.e., towards ages with relatively lower school participation than those corresponding to primary education. If the enrolment ratio for 1968 is standardized on the population of 1958, we obtain 89.6 instead of 86.7, and the difference between this standardized ratio for 1968 and the enrolment ratio for 1958 is 4.1. If we, instead of standardizing the 1968 enrolment ratio on the 1958 population, standardize the 1958 enrolment ratio on the 1968 population, we obtain 81.4. The difference between this standardized enrolment ratio for 1958 and the observed enrolment ratio for 1968 is 5.3 and thus larger than the difference between the observed enrolment ratio for 1958 and the standardized ratio for 1968. Constructing a new standard population equalling the (unweighted) average of the 1958 and 1968 population gives 83.3 as the value for the standardized enrolment ratio in 1958 and 88.0 in 1968. The difference between these two ratios is 4.7 and thus equal to the average of the differences obtained in the two examples above. This illustrates how the standardized enrolment ratio depends on which population has been chosen as standard.

1.5 Level- and age-specific enrolment ratios for selected countries

Table 2 gives the various enrolment ratios defined above for selected countries for 1970. All the eleven countries shown have a similar educational structure as far as age of admission and duration of primary and secondary education are concerned. The admission age to primary education in 1970 was six years and the number of grades in primary and secondary education was six at each level. Columns 1 and 2 give the gross and net enrolment ratios for primary education, while column 3 gives the percentage of the children in the age-group 6 - 11, i.e., the age-group which according to national regulations should be enrolled in primary education, but which is actually enrolled at any level of education. The remaining columns give corresponding information for secondary and higher education.

Primary education

We note the large differences between the gross and net enrolment ratios for all of the developing countries. These differences are due to enrolment of a large number of pupils in primary education older than eleven years caused by late entry

TABLE 2 - Level- and age-specific enrolment ratios for selected countries (1970).

COUNTRY	Primary Education		Age specific enrolment ratio	Secondary Education		Age specific enrolment ratio	Higher Education		Age specific enrolment ratio
	Gross enrolment ratio $\frac{E_P}{P_{6-11}}$	Net enrolment ratio $\frac{E_{P,\,6-11}}{P_{6-11}}$	$\frac{E_{6-11}}{P_{6-11}}$	Gross enrolment ratio $\frac{E_S}{P_{12-17}}$	Net enrolment ratio $\frac{E_{S,\,12-17}}{P_{12-17}}$	$\frac{E_{12-17}}{P_{12-17}}$	Gross enrolment ratio $\frac{E_H}{P_{18-24}}$	Net enrolment ratio $\frac{E_{H,\,18-24}}{P_{18-24}}$	$\frac{E_{18+}}{P_{18-24}}$
	1	2	3	4	5	6	7	8	9
AFRICA									
Ivory Coast	76.7	54.7	54.8	12.6	9.6	35.6	0.8	....	3.6
Libyan Arab Rep.	112.4	87.2	87.3	22.3	14.1	45.0	2.3	....	11.6
Mali	25.4	16.0	16.0	5.2	3.5	14.8	0.1	....	1.9
ASIA									
Indonesia	69.1	52.4	52.4	11.7	8.9	28.6	3.1	....	9.0
Iran	62.2	51.8	51.8	26.3	21.7	34.1	2.1	....	7.3
Korea, Rep. of	104.5	95.4	96.0	41.4	37.4	48.3	5.2	....	8.6
LATIN AMERICA									
El Salvador	85.3	58.7	58.7	19.1	12.4	45.9	2.3	....	10.7
Mexico	105.5	82.3	82.3	22.6	19.1	48.4	4.0	....	7.6
Peru	109.9	74.7	75.4	37.2	25.7	62.0	7.3	....	23.6
EUROPE									
Netherlands	101.8	93.2	93.2	74.3	68.2	77.9	10.9	....	15.6
Spain	109.5	93.5	104.7	58.3	37.5	55.1	6.1	....	13.9

and repetition. Calculations based on the figures given in columns 1 and 2 show that the percentage of the pupils aged 6 - 11 who were enrolled in primary education ranged from 63 in Mali to 92 in the Netherlands.

We note that the age-specific enrolment ratios given in column 3 for all countries are almost identical to the net enrolment ratio given in column 2. The reason is that for these countries all pupils aged 6 - 11 years are enrolled in primary education. The small differences between the ratios given in columns 2 and 3 for Korea and Peru indicate that a few pupils in the age-group 6 - 11 are enrolled in secondary education (pre-primary education is not considered here). The fact that the age-specific enrolment ratio exceeds 100 for Spain indicates an over- or underestimation in the population or enrolment data used for this country.

Secondary education

Columns 4 and 5 give the gross and net enrolment ratios for secondary education, while column 6 gives the age-specific enrolment ratios for the age-group 12 - 17 years. The gross enrolment ratio is again larger than the net ratio for all countries. As for primary education, the difference is due to enrolment of pupils in secondary education outside the age-range 12 - 17. Contrary to what was the case for primary education, the age-specific enrolment ratio for the age-group 12 - 17 is considerably larger for all countries except Spain than the gross or net enrolment raito for this level. The reason for this is that a large proportion of pupils aged 12 - 17 years is not enrolled in secondary education but in primary education. Calculations based on the figures given in columns 5 and 6 indicate that the percentage of the pupils aged 12 - 17 who were enrolled in secondary education ranged from 24 in Mali to 88 in the Netherlands. As could be expected the percentage is lower in the developing countries than in the two European countries.

Higher education

Column 7 of Table 1 gives the gross enrolment ratio for higher education, calculated by dividing the total enrolment at this level by the population aged 18 - 24 years. The net enrolment ratio for higher education could not be calculated as data on the age-distribution of enrolment in higher education are generally not available. The age-specific enrolment ratios shown in column 9 are approximate. They have been calculated by dividing the sum of the total enrolment in higher education plus the enrolment in primary and secondary education of pupils older than 17 years, by the population aged 18 - 24 years. The enrolment figure used thus includes pupils older than 24 years, yielding an upward bias in the estimation of the enrolment ratios. The data for the developing countries included in this study indicate that a relatively small part of the pupils older than 17 years are enrolled in higher education (see columns 7 and 9). The percentage ranges from 5 in Mali to 60 in Korea. The corresponding figure for the Netherlands was 70.

1.6 The choice of the enrolment ratio to be used

The choice of the enrolment ratio to be used for illustrating the development of enrolment relative to population within a given country or for comparisons between countries, depends on the problem to be analyzed. We have shown that the numerical values of the net and gross level enrolment ratios and the age-specific enrolment ratios may vary quite considerably, particularly for developing countries. It is important therefore to choose the ratio which most appropriately illustrates the problem we wish to analyze.

If we desire to measure the percentage of a given age-group which is enrolled at school regardless of level, the problem is straightforward since the age-specific enrolment ratios give a clear answer. Thus, Table 2 shows that in the

Ivory Coast 54.8% of children aged 6 - 11, 35.6% of the population aged 12 - 17 and 3.6% of the population aged 18 - 24 years were enrolled at school in 1970. This is however a purely demographic measure, which only indicates the percentage of a given age-group enrolled at school, without giving any information concerning the level of education at which the pupils are enrolled. For this type of information we would have to turn to the level enrolment ratios. The gross enrolment ratio for primary education gives the total primary school enrolment divided by the population in the age-group which according to national regulations should be enrolled at this level. However, because of over-aged pupils in developing countries due to repetition and late entry, it is difficult to relate the enrolment at a given level of education to any particular age-group. The figure given in column 1 of Table 2 for the Ivory Coast suggests, for example, that primary education is provided for a number of children equal to 76.7% of the children in the primary school age-group. However, the age-specific enrolment ratio shows that only 54.7% of the children aged 6 - 11 are actually enrolled at school. The problem is further illustrated by the fact that the gross enrolment ratios given for Libya, Korea, Mexico, Peru, the Netherlands and Spain all exceed 100%. (Note that, due to repetition, this may happen even in a country where all children start school at the legal entry age.) At the same time, the coverage of primary education is larger than suggested by the age-specific enrolment ratio as there are pupils older than eleven years enrolled at this level. Thus neither of these two ratios gives a completely satisfactory description of the coverage of primary education. The same is true for the net level enrolment ratio since it refers only to the enrolment of pupils aged 6 - 11 years in primary education. The difficulty in all these cases is to find the appropriate age-group against which to measure the recorded enrolment. Based upon the enrolment ratios for the Ivory Coast, one might say that 54.7% of the children aged 6 - 11 years were enrolled at school in 1970 while the enrolment capacity of primary schools was equivalent to about 76.7% of this age-group had there not been over-aged pupils enrolled.

The figures given for secondary education indicate even larger differences between the various enrolment ratios than for primary education. Thus, 35.6% of the population aged 12 - 17 years in the Ivory Coast were enrolled at school while the gross enrolment ratio for secondary education was only 12.6%. Contrary to the state of affairs in primary education, the age-specific enrolment ratio in secondary education is larger than the corresponding gross enrolment ratio, due to the enrolment of pupils aged 12 - 17 years in primary education. The net enrolment ratio is furthermore considerably smaller than the gross enrolment ratio since a large proportion of the pupils enrolled in secondary education is older than 17 years.

The large differences between the various enrolment ratios clearly indicate the need for employing such ratios with caution, specifying each time the way in which they have been derived. For example, the considerable differences between the age-specific enrolment ratios for the age-group 12 - 17 years and the gross enrolment ratios for secondary education show the importance of not using the former ratios as indications of the coverage of secondary school enrolment. The same holds true for the corresponding ratios referring to primary and higher education. It is consequently very important to interpret enrolment ratios with caution and not to use them for measuring aspects for which they are not appropriate. Enrolment ratios are stock measurements. They merely provide an index of the level of enrolment at a given point in time, measured relatively to the population of a given age-group. As such the enrolment ratios are sometimes considered as an index of input of children into the educational system. It is not however a very precise measure in most cases since the pupils enrolled may come from different cohorts and may be enrolled in different grades. Thus, of two countries having the same gross enrolment ratio for primary education, one may have an even distribution of enrolment over grades while the other may have a relatively large percentage of its total primary school enrolment in grade 1. Furthermore, the

first country may have a considerable number of repeaters and over-aged pupils, while the second country may have most of its enrolment within the official age-ranges. It is therefore clear that equal enrolment ratios for these two countries do not show differences in the composition of the pupil input.

Finally, it should be noted that enrolment ratios are not designed for measuring the level of output from an educational system. Consider for example two countries which both have, in a given year, 60% of their children aged 6 - 11 enrolled. In Country A, this enrolment ratio might have been obtained by enrolling 60% of the children aged six years every year during six years and keeping all of them at school throughout this period. In Country B the same enrolment ratio might have been obtained by similarly enrolling all children aged six years, but then due to high regular dropout, maintaining only 20% of them at school by the end of the six-year period. If the enrolment ratios are used as an indicator of the level of output from the six-year system, in relative terms the outputs are equal for the two countries. However, if the number used is limited to those who successfully complete six years of education, the output of Country A is three times that of Country B. Thus, it is clear that the enrolment ratios in this situation give neither a good indication of the efficiency of the two school systems nor of the number of successful school leavers. They only provide a measure of the level of enrolment in a given year relative to the population of a given age-group.

It should be noted that the level of dropout assumed in Country B in the example above, although extremely high is by no means unusual. Calculations show that the percentage of the pupils entering grade 1 of primary education in 1967 and ultimately reaching grade 4, was on average only 42 in Latin America, 53 in South Asia and 67 in Africa[1].

2. The projeciton of new entrants

One important aspect of projecting school enrolment is the estimation of the future number of new entrants to the educational system. In countries with universal primary education, where practically all new entrants start school at the official entry age, the problem is relatively simple: the number of new entrants in most cases can be expected to equal the population in the admission age-group. The number of new entrants for future years may consequently be derived directly from the population projections. The matter is more complex in developing countries as new entrants usually come from several age-groups. We shall illustrate below some of the problems arising when projecting the future number of new entrants for these countries and suggest possible ways of solving these problems by using data on new entrants by age.

2.1 Apparent intake rates

In a country where all new entrants start school at the same age, the number of new entrants to the educational system in a given year depends upon the number of children in the admission age-group and the proportion of this age-group which enters school. Assuming that children start school at the age of six, this may be expresses as:

(6) $N^t = e^t P_6^t$ where N^t = Number of new entrants in year t

P_6^t = Population aged 6 years in year t

e^t = Intake rate in year t. We shall later refer to this as the apparent intake rate.

1) See "Educational Development, World and Regional Statistical Trends and Projections until 1985", background paper prepared for the 1974 World Population Conference, Unesco Office of Statistics, Paris, January 1974.

For countries where the intake rate equals 1, the number of new entrants is equal to the population aged six years. However, difficulties arise if formula (6) is used for projecting new entrants for countries where new admission comes from several age-groups, which is the case in most developing countries. For these countries, if in addition to new entrants from the admission age-group, children older than the official age of entry were enrolled, the intake rate may exceed 1 during a certain period. In this case it is not evident what the upper limit of the intake rate will be or for now many years it will exceed 1. Table 3 shows the development of the intake rate for boys for 15 selected countries for all years after 1960 for which data on new entrants are available. We note that the rates are considerably larger than 1 for several countries. It is clear that extrapolating the trend of the rate for Iraq, for example, may lead to unreasonable results. On the other hand, it cannot be excluded that the intake rate for Iraq will continue to increase for several years after 1970; the data for Libya, Panama and Paraguay, for example, show that it is possible for the value of the rate for Iraq in 1971 to be considerably surpassed. It all depends on the future development of the factors determining the intake rates. As the development of these factors differ between countries, the upper limits and speed at which these limits will be reached will vary from one country to the next.

The main factor causing intake rates to exceed 1 is rapid increase over time in new admission, for countries where new entrants are recruited from several age-groups. The effect is further reinforced if at the same time there is a shift in the age-distribution of new entrants towards younger ages. This is illustrated in the table below for a hypothetical country where the new entrants are assumed to come from two age-groups only, and where the population in these two age-groups for the sake of simplifying the example, is assumed to be constant during the period considered. The effects of mortality furthermore are ignored.

Age	1970				1971				1972			
	Population	% intake	New entrants	Intake rate *	Population	% intake	New entrants	Intake rate *	Population	% intake	New entrants	Intake rate *
6 years	100	40%	40	0.90	100	60%	60	1.15	100	80%	80	1.20
7 years	100	50%	50		100	55%	55		100	40%	40	

Age	1973				1974				1975			
	Population	% intake	New entrants	Intake rate *	Population	% intake	New entrants	Intake rate *	Population	% intake	New entrants	Intake rate *
6 years	100	90%	90	1.10	100	100%	100	1.10	100	100%	100	1.00
7 years	100	20%	20		100	10%	10		100	0%	0	

* This rate has been obtained by dividing the total number of new entrants aged 6 and 7 years by the population aged 6 years.

The example starts out by assuming that 40% of the six-year-olds and 50% of the seven-year-olds start school in 1970, leading to an intake rate of 0.90 if the population aged six-years-old is used as the basis for the calculation. In 1971 there is an increase in the intake from both ages, leading to an intake rate of 1.15. In 1972 the increase in enrolment of six-year-olds continues, while the new enrolment of seven-year-olds decreases to 40%. As 60% of this cohort already was enrolled in 1971 it would not be possible to enrol more than 40% since we assume that a child can only enter school once. The increase in the enrolment of six-year-olds continues until 1974, where it reaches 100% of the age-group while the decrease in the new enrolment of seven-year-olds reaches zero in 1975, at which time the intake rate is 1.00.

In this example the intake rate reached 1.20 as its maximum value and remained higher than 1 for four years. It is obvious that the upper limit and the development over time would have been different if the intake rates for each of the two age-groups had developed differently, and even more so if the new entrants had come from more than two age-groups. A satisfactory analysis of this problem requires data on new entrants by age for consecutive years. Such data will permit us to study the intake rate by single years of age and not only the general intake rate as defined by (6). If the new entrants come from several age-groups, this may be expressed as:

$$(7) \qquad N^t = e_6^t P_6^t + e_7^t P_7^t + \ldots\ldots + e_{6+x}^t P_{6+x}^t$$

where (6+x) is the oldest age-group from which new entrants are drawn and $e_6^t, \ldots\ldots, e_{6+x}^t$ are the percentages of each age-group starting school in year t. Combining equations (6) and (7), the apparent intake rate e^t may be expressed as:

$$(8) \qquad e^t = e_6^t + e_7^t \frac{P_7^t}{P_6^t} + e_8^t \frac{P_8^t}{P_6^t} + \ldots\ldots + e_{6+x}^t \frac{P_{6+x}^t}{P_6^t}$$

It is clear from this equaiton that e^t may exceed 1. It will remain stable over time as long as $e_6^t, \ldots\ldots, e_{6+x}^t$ and the age-structure of the school population remain unchanged. Built on past data on the age-distribution of new entrants, the trend of the intake rates by single years of age may be studied and projected. Note however that even in this case upper limits have been fixed each year for each of the intake rates by single years of age since they are inter-related over time. This is the sort of limit which had to be applied in the example given above where the intake rate for seven-year olds in 1972 could at the maximum be 40% as 60% of the cohort were already enrolled at school the previous year. In a more general manner, this is illustrated in the table below where $P_6^t, P_7^{t+1}, \ldots\ldots, P_{6+x}^{t+x}$ refer to children belonging to the same cohort.

Year	Children admitted at the official age of admission	Children admitted, 1 year after the official age of admission	Children admitted, x years after the official age of admission	Total admission
t	$\underline{e_6^t P_6^t}$	$e_7^t P_7^t \ldots\ldots$	$e_{6+x}^t P_{6+x}^t$	N^t
t+1	$e_6^{t+1} P^{t+1}$	$\underline{e_7^{t+1} P_7^{t+1}} \ldots\ldots$	$e_{6+x}^{t+1} P_{6+x}^{t+1}$	N^{t+1}
t+x	$e_6^{t+1} P_6^{t+1}$	$e_7^{t+x} P_7^{t+x} \ldots\ldots$	$\underline{e_{6+x}^{t+x} P_{6+x}^{t+x}}$	N^{t+x}

The sum of the intake rates $\underline{e_6^t} + \underline{e_7^{t+1}} + \ldots\ldots + \underline{e_{6+x}^{t+x}}$ can therefore at maximum reach 1, since these rates refer to the same cohort of children. Thus, if e_6^t increases rapidly over time, $e_7^{t+1}, \ldots\ldots, e_{6+x}^{t+x}$ will decrease in the future. Consequently, although the apparent intake rate defined by (8) during a certain stage of development of primary education may exceed 1, in the long run it will decrease again to 1 and the number of new entrants will be determined by the population in the official admission age.

One possible way of ensuring that the sum of the intake rates for one cohort does not exceed 1, would be to project each intake rate by single years of age separately under the constraints that:

$$(9) \qquad E = e_6^t + e_7^{t+1} + \ldots\ldots + e_{6+x}^{t+x} \leq 1.$$

where E is the intake rate for the cohort being six-years-old in year t.

The above analysis ignores mortality. If this aspect is taken into account, the unequality sign in (9) will be effective, as E will be less than 1. This may be seen from the following. Assume for the sake of simplicity that the mortality rate is the same for all the ages from which new entrants are drawn. Denoting this common rate by a, the number of children aged (6+x) years in year (t+x) equals:

$$P_{6+x}^{t+x} = \left(1 - a\right)^x P_6^t = b^x P_6^t$$

where $b = 1 - a$ is the survival rate. Combining this with the definitions of $e_6^t, \ldots\ldots, e_{6+x}^{t+x}$ and using equation (9) gives:

$$(10) \qquad E = \frac{N_6^t}{P_6^t} + \frac{N_7^{t+1}}{bP_6^t} + \frac{N_8^{t+2}}{b^2 P_6^t} + \ldots\ldots + \frac{N_{6+x}^{t+x}}{b^x P_6^t} .$$

Assuming that all surviving children from this cohort are enrolled at school in year (t+x), the following accounting relationship holds:

$$N_{6+x}^{t+x} = b^x P_6^t - \sum_{i=0}^{i=x-1} N_{6+i}^{t+i}$$

i.e., the number of children aged (6+x) years who have not entered school before year (t+x) equals the population aged (6+x) years that year minus all entrants in previous years from this age-group. Introducing this into (10) gives:

$$E = \frac{1}{P_6^t}\left[N_6^t + \frac{1}{b} N_7^{t+1} + \frac{1}{b^2} N_8^{t+2} + \ldots\ldots + \frac{1}{b^{x-1}} N_{6+x-1}^{t+1-1} + \frac{1}{b^x}\left(b^x P_6^t - \sum_{i=0}^{i=x-1} N_{6+i}^{t+i}\right)\right] =$$

$$\frac{1}{P_6^t}\left[P_6^t + \frac{\left(b^x - 1\right) N_6^t}{b^x} + \frac{\left(b^{x-1} - 1\right) N_7^{t+1}}{b^x} + \ldots + \frac{(b-1)\, N_{6+x-1}^{t+x-1}}{b^x}\right] = \frac{1}{P_6^t}\left[P_6^t + B\right] = \underline{\underline{1 + \frac{B}{P_6^t}}} .$$

where B is negative since $(b-1) < 0$, and therefore $E < 1$. If $b = 1$, i.e., $a = 0$, then $E = 1$. For instance, if in the example given in the table above we assume that $a = 0.001$ we obtain the following E for the cohort of children aged 6 years in 1971:

$$E = \frac{1}{100}\left[100 + \frac{(0.998-1)60}{0.998} + \frac{(0.999-1)40}{0.998}\right] = \frac{1}{100}\left[100 - 0.16\right] = \underline{\underline{0.9984}}$$

Thus, the effect of mortality in this example is negligible and can be ignored for all practical purposes.

The effects of immigration and emigration could also be analyzed by the formula developed above.

2.3 Entrants proportions by single years of age

As discussed above, the projection of age-specific intake rates does not take into account the fact that the number of potential new entrants in a given year of a given age depends on the number of children enrolled from this cohort in previous years. For example, assuming that no children enter school before the age of six, the maximum number of eight-year-olds that may enter school in 1975 depends on how many seven-year-olds entered in 1974 and how many six-year-olds entered in 1973. This aspect may be taken implicitly into account by checking that the constraint given by equation (9) is observed when making the projections. However, if data on new entrants by single years of age are available for past years, a more satisfactory method based on age-specific entrance proportions rather than on age-specific intake rates may be used [1]. The entrance proportion for a-year-olds is defined as:

$$(11) \qquad q_a^t = \frac{N_a^t}{U_a^t}$$

where N_a^t = children aged a-years in year t who enter grade 1 of primary education in that year

U_a^t = children aged a-years in year t who have never entered school in previous years (i.e., potential new entrants in year t from age-group a)

q_a^t = proportion of the children aged a-years in year t who have not entered school before and who enter school in year t.

Thus, while the intake rates refer to intake of new entrants from the whole cohort, including those who have already entered school, the entrance proportions refer only to intake from the group of children who have not so far entered school. The relationship between the age-specific intake rates and the entrance proportions may be seen from the following. For example, assume that nobody enters school before the age of six, and ignoring mortality and migration, the number of potential new entrants aged eight-years in year t equals:

$$(12) \qquad U_8^t = P_6^{t-2} - N_6^{t-2} - N_7^{t-1}$$

Introducing this into (11) gives:

$$(13) \qquad q_8^t = \frac{N_8^t}{P_8^{t-2} - N_6^{t-2} - N_7^{t-1}}$$

Bearing in mind that $N_a^t = e_a^t P_a^t$ and that our assumption concerning mortality and migration implies that $P_6^{t-2} = P_7^{t-1} = P_8^t$, the entrance proportion for eight-year-olds may be expressed as:

[1] This method has been proposed by Professor T. Thonstad in an unpublished note prepared for the Unesco Office of Statistics and entitled: "Notes on a model for projecting primary school enrolment based on projection of intake rates or entrance proportions", Paris, October 10, 1974.

$$(14) \qquad q_8^t = \frac{e_8^t P_8^t}{P_6^{t-2} - e_6^{t-2} P_6^{t-2} - e_7^{t-1} P_7^{t-1}} = \frac{e_8^t}{1 - e_6^{t-2} - e_7^{t-1}} .$$

Thus, there is a clear relationship between these two sets of parameters.

Based upon past observations of new entrants by single years of age, the potential new entrants for each year and age-group may be derived from the following accounting relation:

$$(15) \qquad U_a^t = U_{a-1}^{t-1} - N_{a-1}^{t-1} .$$

Once all U's have been derived from past years, the development of the age-specific entrance proportions may be calculated from relation (11) and projected for future years. Based on these projections of the q's and the U's derived from (15), the total number of new entrants for future years may be derived from:

$$(16) \qquad N^t = \sum_a q_a^t U_a^t$$

We shall illustrate how this system works using data on new entrants for Venezuela. Table 4 shows the age-specific intake rates for the period 1963-71 for girls and boys together. The bottom line of the table gives the apparent intake rate for the same period calculated by dividing the total number of new entrants to grade 1 by the population aged six years. The jump in the apparent intake rate between 1969 and 1970 is caused by the introduction of automatic promotion in 1970 which led to a sudden rise in the number of new entrants in that year since more places were made available to potential new entrants seeking admission.

Table 5 gives the number of potential new entrants by single years of age for the period 1963-71, expressed as a percentage of the number of six-year-olds in the relevant cohort (mortality and migration have been ignored). The figures in Table 5 correspond to the denominator of equation (14), the only difference being that the former are expressed as percentages. Thus, the percentage given for eight-year-olds in 1965 (40.7) was obtained by subtracting the intake rates for six-year-olds in 1963 (10.2) and for seven-year-olds in 1964 (49.1) from 100. Based on the data given in Tables 4 and 5, the age-specific entrance proportions may be calculated using a formula similar to the one given by equation (14) for the eight-year-olds. These proportions are given in Table 6.

TABLE 4 - Age-specific intake rates for the period 1963-71.

Boys and Girls. (Venezuela)[1].

	1963	1964	1965	1966	1967	1968	1969	1970	1971
6 years	10.2	10.9	12.4	14.7	15.7	15.9	17.3	21.8	24.8
7 years	48.6	49.1	50.0	50.2	48.2	48.7	49.5	50.8	48.7
8 years	19.6	19.8	19.8	18.4	17.1	17.2	17.7	21.2	20.8
9 years	11.2	11.0	10.6	9.5	8.9	8.5	9.0	10.8	10.2
10 years	7.2	7.3	6.9	6.1	5.5	5.3	5.6	6.6	6.1
11 years	4.4	4.2	4.2	3.4	3.2	2.9	3.1	3.6	3.4
12 years	3.0	2.9	2.7	2.4	2.1	2.0	2.1	2.1	2.0
13 years	1.8	1.5	1.4	1.1	1.0	0.9	0.9	0.8	0.9
14 years and above	0.8	0.8	0.7	0.5	0.5	0.4	0.3	0.2	0.1
apparent intake rate	1.04	1.05	1.06	1.06	1.03	1.02	1.06	1.17	1.16

1) The data have been revised to correct some minor inconsistencies, as in the original data the sum of the intake rates for the cohorts aged six-years-old in 1963, exceed 100.

TABLE 5 - Potential entrants expressed as a percentage of relevant cohort.

Boys and Girls. (Venezuela).

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
6 years	100	100	100	100	100	100	100	100	100	100
7 years		89.8	89.1	87.6	85.3	84.3	84.1	82.7	78.2	75.2
8 years			40.7	39.1	37.4	37.1	35.6	34.6	31.9	29.5
9 years				20.9	20.7	20.3	19.9	17.9	13.4	11.1
10 years					11.4	11.8	11.8	10.9	7.1	3.2
11 years						5.9	6.5	6.2	4.3	1.0
12 years							3.0	3.4	2.6	0.9
13 years								0.9	1.3	0.6
14 years									0.1	0.4
15 years										0.0

TABLE 6 - Age-specific entrance proportions. Boys and Girls. (Venezuela).

	1963	1964	1965	1966	1967	1968	1969	1970	1971
6 years	10.2	10.9	12.4	14.7	15.7	15.9	17.3	21.8	24.8
7 years		54.7	56.1	57.3	56.5	57.8	58.9	61.4	62.3
8 years			48.7	47.1	45.7	46.4	49.7	61.3	65.2
9 years				45.5	43.0	41.9	45.2	60.3	76.1
10 years					48.2	44.9	47.5	60.6	85.9
11 years						49.2	47.7	58.1	79.1
12 years							70.0	61.8	76.9
13 years								88.9	69.2
14 years									100.0

If we assume, for the sake of illustration, that the age-specific entrance proportions for 1972 will remain the same as in 1971, then the number of new entrants in 1972 can be derived by using equation (16). The q's are obtained from Table 6 and the U's are obtained by multiplying the figures in the last column of Table 5 by the size of the relevant cohorts, i.e., the percentage for seven-year-olds (75.2) is multiplied by the number of six-year-olds in 1971, the percentage for eight-year-olds (29.5) is multiplied by the number of six-year-olds in 1970, etc.

The new entrants in 1973 can be projected by calculating a new set of U's for this year applying equation (15) and then following the same procedure as for 1972.

Examining the past development of the entrance proportions in Table 6, it does not seem reasonable to assume that they will remain stable after 1971 as almost all of them show an increasing trend. It seems reasonable to project this trend into the future. We notice that such projections require long time-series on new entrants in order to have a sufficient number of observations of the entrance proportions. The nine years for which data were available for Venezuela in the above example provide, for instance, only five observations of the entrance proportions for ten-year-olds. Moreover, the larger the age spread of the new entrants, the longer the time-series must be in order to provide a series of entrance proportions of a given length for the oldest age-group from which new entrants are recruited.

TABLE 3 - Intake rates for selected countries (Boys)[1].

COUNTRY \ YEAR	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
ASIA														
Iraq							0.81	0.80	0.84	0.92	1.01	1.04	1.04	
Korea, Republic of					1.06	1.06	1.07	1.16	1.14	1.13	1.14	1.09	1.04	1.05
Syria					1.09	1.01	1.01	0.98	1.06	1.04	1.06			
AFRICA														
Libyan Arab Rep.						1.26	1.34	....	1.23	1.18	1.34	1.46	1.42	
Madagascar					0.91	0.97	....	....	....	1.06	1.09	1.15		
Mauritius		1.06	1.11	1.10	1.04	0.98	1.04	1.03	1.01	0.96	0.93	1.00		
Rwanda				1.40	1.43	1.02	1.05	1.03	....	0.96	0.79	0.69	0.73	
LATIN AMERICA														
Argentina			1.21	1.26	1.21	1.20	1.15	1.22	1.19	1.24				
Chili								1.24	....	1.29	1.24	1.45	1.32	
Colombia	1.20	1.20	1.23	1.26	1.24	1.17	1.18	1.25	1.28					
Costa Rica	1.15	1.07	1.17	1.12	1.14	1.18	1.13	1.16	1.13	1.10	1.11	1.05	1.11	
Ecuador	1.28	....	1.26	1.36	1.37	1.37	1.32	1.34	....	....	1.24	1.19		
Guatemala		0.87	0.89	0.95	0.93	0.93	0.95	0.97	1.02	1.06	1.03			
Panama		1.06	1.18	1.08	1.05	0.99	0.98	1.03	1.02	1.09	1.12	1.35	1.25	
Paraguay					1.42	1.37	1.32	1.32	1.36					

1) These rates are defined as the total number of new entrants to grade 1 of primary education a given year divided by the number of children in the legal admission age-group.